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THE LIMITS OF ORGANIC EVOLUTION.

BY H. W. CONN, PH.D.

THE theory of evolution implies a past, a present and a future. Since the time of Darwin the past and present of the organic world have been studied with the result of showing that the history has been one of evolution. Having now reached this conclusion, and having discovered many of the laws of advancement in living nature, we are getting into a position where we may begin to study the future. It is the object of this paper to indicate certain limits in development toward which the organic world have long been tending.

The idea of evolution implies that there has been a gradual rise in the scale of organisms from the lowest to the highest. But when palæontologists have attempted to show this gradual rise by a study of fossils they have had much less success than the theory of evolution would lead us to expect. That there has been a general advance from the earliest fossils in the Silurian until now, seems unquestionable. But instead of being the most palpable result of study, this advance is so obscure as to cause surprise to all who have attempted to make it out in detail. Darwin expressed his surprise at the lack of evidence, and the difficulties have increased rather than decreased since he wrote. In some groups there has been an undoubted advance; the vertebrates, for instance, showing this in a marked manner. In a majority of groups, however, we do not find it, for while the animals have not in any case remained absolutely stationary, the development, as a rule, has consisted chiefly in the increase and diversity of species and genera. It is a matter of continual surprise to naturalists to

find constantly increasing evidence of the great diversity of life which must have existed in the Silurian era. With the advance of our knowledge of these earliest fossiliferous rocks, new groups are constantly being added to the already extensive fauna. Our knowledge of these times is still very scanty, but even now we know that the fauna was highly developed. All of the subkingdoms of the animal world were represented, about five-sixths of the orders and suborders of the present time, many families and a few genera. Bearing in mind the necessary incompleteness of our collections, we must conclude that this fauna contained representatives of a large proportion of the animals now existing. Nor were the various groups represented by these lowest types simply. The Cœlenterata contained Hydrozoa and Actinozoa; among echinoderms we find echinoids; among mollusks we find cephalopods; among Arthropoda were Tracheata in the shape of scorpions. And while these types were not developed as highly as they are now, their mere existence is enough to indicate that already a large advance in the evolution had taken place. If this is the case it becomes plain that evolution since that time has been almost entirely confined to the elaboration of the groups then existing.

Now we are not at liberty to assume an indefinite amount of time prior to the Silurian. Of course it is impossible to say just how long a time elapsed between the origin of life and the Silurian, but it seems hardly possible that it could have equaled the time since then. But upon evolutionary theories the animal kingdom must have developed during that period from the lowest unicellular condition to the complex and diverse fauna of the Silurian. When we consider, therefore, that during this time all of the important groups of the animal kingdom* arose, and that none have arisen since that time, it becomes quite evident that evolution must have progressed with greater rapidity at that time than it has since. This conclusion is no new one, for many naturalists have seen the necessity of making some such assumption. It will, indeed, be generally acknowledged that evolution at earlier times was more rapid than at present.

Now it follows as a direct result of this fact that the evolution of organisms is approaching an end, and that it will eventually cease. If the rapidity of evolution as a whole has been decreasing since the beginning of life, it is evident that unless something

*[It is very doubtful whether there were any Vertebrata during the Silurian.—*Ed.*]

occurs to begin the process over again, evolution must eventually cease.

This would lead us to the conception of the animal kingdom as not unlimited in the extent of its development, but as having a definite end. This may be made clearer by two comparisons. First, consider the life of any individual. This begins with the fertilization of the ovum. Fertilization seems to endow the ovum with a large amount of vitality, or what has been called growth force. This growth force causes the ovum to begin to divide and grow with great rapidity, and the changes which take place as the result of this invigoration, are very great during the early part of the development. But immediately from the first the rapidity of this growth begins to decrease. As the individual becomes older its rate of growth becomes less and less, the invigorating force gradually expending itself, until finally a condition is reached where no further growth takes place. For some time now the animal remains in a state of equilibrium, but finally begins to go down hill and dies. A better comparison still may be found in the life of a tree. Here also we find at the outset a rapid growth and advance, very early the rapidly growing stems give rise to buds which are to become the great branches of the coming tree, and in a very short time the shape of the tree is determined by the growth. All of the larger branches have appeared, and they have already given rise to many of the smaller ones. But here also the rate of growth diminishes, and as the tree becomes older and larger it grows less rapidly. Finally at a certain size its growth practically stops. It does not of course actually cease to grow. It is continually producing new leaves, new twigs; old branches are being in some places expanded, in others they are dying and disappearing. There is thus a constant change and growth taking place in the various parts, but the growth of the tree as a whole has ceased. For a long time, perhaps the tree may remain in this condition, but little by little the process of decay encroaches upon that of growth, and finally the tree dies.

These examples are of course simple analogies, and it is a question how far they may be regarded as applying to the animal kingdom as a whole; but there are many facts which indicate that the history of the organic world as a whole is parallel to the life of the individual, in part at least. That the relations of ani-

mals in the world are to be looked upon as that expressed by a branching tree is now perfectly demonstrated. That all of the great branches of this tree, as well as many of the smaller ones, had made their appearance at the time of our first record of life, is also proved. That evolution since that time has consisted chiefly in the elaboration of these branches by increasing their division and the diversity of species and small groups, is becoming more and more evident. That there has been a slowing up of development in recent times is a fact which is strongly forcing itself upon naturalists; and the conclusion has found expression in the statements sometimes made that no new species are arising to-day, or that the present is a period of comparative rest. The same general principle is taught from embryology, for very early in their history do embryos become separated into the subkingdoms to which they belong, while more and more slowly does the separation into the smaller groups take place. All of these facts together strongly indicate that the illustrations used above are in part real illustrations, and that the whole animal kingdom must be looked upon as an individual starting its history with a vigorous growth which is gradually expending itself. Whether or not this growth will reach a limit, and whether or not it will eventually cease so that the animal kingdom will disappear, it is our purpose to consider.

That the organic world is approaching a limit to its development is a conclusion which does not depend upon any vague idea of growth force for its support; for a little thought upon discovered laws will clearly show us that there must be a limit to advance. The best definition which has ever been given of the grade of structure of animals is the degree to which differentiation of organs is carried. Evolution as it tends to raise the grade of animals is constantly increasing the amount of differentiation. A distinction must be made, however, between differentiation and specialization. Evolution sometimes results in retrogression, and in these cases differentiation becomes less rather than greater. Evolution does not, therefore, always produce a greater differentiation, but in all cases, even in those of retrograde development, it does produce a specialization of parts, and we may rightly regard evolution in the animal kingdom as a process of specialization. Now it is plain that this process can not go on forever. A low undifferentiated unspecialized organism

has an infinite possibility in its lines of specialization. A simple spherical mass of cells, the supposed common ancestor of the animal kingdom, may be modified in a very great variety of directions, each of which may give rise to a different type of animal. This possibility lies in the fact that it is as yet undifferentiated and unspecialized. But just as soon as it does become modified in any one direction the possibilities decrease. Some of the descendants of this ancestor becoming vertebrates are forever precluded from becoming anything else; others becoming mollusks must remain mollusks forever, with all of their descendants. And as later descendants become further modified in any direction into definite types, the chance for future modification becomes rapidly less. It is only the absolutely undifferentiated which has infinite possibilities, for as soon as a single step is taken in any direction they become finite. Now it is plain, since evolution does not retrace its steps, that with every step in advance the possible lines of development become less and less. All the descendants of the vertebrate line must conform to the vertebrate type. The vertebrate becomes separated into fish, reptile and mammal, and the individual of each group is still further fettered in its development by the special line which its ancestors have taken. The descendants of the animals which have started the order of birds can not take any new line. They can develop to perfection this type, but there they must stop. And so on, with every advanced step the possibilities of expansion are constantly decreasing.[1]

Now a continued specialization of this sort is sure to reach a limit eventually, it must run to extremes and then stop. Development must reach a position where further advance is no longer possible. Let us illustrate this principle by a concrete example. A five-toed appendage is an unspecialized form which we may conceive as modified in many directions. It may become a grasping organ or a supporting organ or a swimming organ, etc. In the group to which our ruminants belong this appendage has become a supporting structure. In this same group there has further been a tendency to rise upon the toes, in such a manner that instead of walking on the soles of the feet and palms of the hands, the animals in question walk more and more upon the fingers and toes. When this peculiarity first began to manifest itself, the mammals had five toes. As it became more and more

[1] This idea can be found fully expressed in the writings of Professor Cope.

marked the shorter toes were little by little lifted from the ground and became of little or no use. In successive ages we find the shorter toes becoming smaller while the middle toe becomes larger. This line of specialization has continued until it has reached a limit in the horse, which has lost all but one toe on each foot, and walks on the extreme tip of this toe. Now it is perfectly evident that a limit has been reached in this case. The horse may perhaps in the future lose the rudimentary splint bones which still remain, but he can not lose his last toe; and it is therefore impossible to conceive any further development of the horse in this direction. Now the same principle will apply to all other lines of specialization, although we may not always be able to see what this limit may be. Physical laws would of themselves set limits to every line of advance, even if there be no such limits determined by the organism itself.

It is easy to find examples which will show that such has been the general history of groups in the past. Some have reached the extreme of their development in the distant past, and have ceased to advance or disappeared. Others seem even now to be at the summit of their advance, and others still are yet advancing. The line of development represented by the trilobites has completely exhausted itself. It rapidly approached its limits even in the Silurian, and then began to dwindle away and has disappeared completely. The brachiopods had also at this time reached their point of highest specialization, and became a highly developed group even at this early age. Since then they have remained stationary as to their organization, having steadily decreased in numbers, and the few that are left show no advance over the Silurian forms. The cephalopod mollusks gradually increased in complexity during the Palæozoic, and finally a limit of the shelled forms was reached in the ammonites of the Jurassic and Cretaceous. The culmination was followed by extinction. Meantime a second line of development began, that of the naked cephalopods, and this has gone on advancing until the present time. The decapod Crustacea represent a group which is even now near its culmination. From their first appearance in the Carboniferous there has been a tendency toward concentration of organs toward the head. As this specialization advanced the abdomen became smaller while the head region became larger. Finally in the crabs, which appeared in the Jurassic, everything was concen-

trated into the head region; the abdomen being little more than a rudiment. Evidently we are here near a limit, and we may look upon the crabs of to-day as the culmination of the special line of development which has characterized this line of animals. The vertebrates in general have been continually advancing during geological times with a continued increase in specialization and in multitude of types. But even here there has been the same story of limitation. The ganoids culminated in the Devonian, and have advanced no farther. One great line of reptiles reached its limit in the Jurassic. And so everywhere. The study of every group teaches that the past history has been a gradual specialization, which approaches a limit. In many cases in the past this limit has been reached and advance ceases; while in others animals are still on their road toward it.

It is plain, therefore, that the evolution of the whole animal kingdom is slowly but inevitably approaching an end. With every advance in differentiation the possible lines of development decrease, and since the actual lines followed are tending to run themselves out, the whole must eventually stop.

Recognizing, then, that there must be a limit to advance, we must next ask the question, whether after this limit is reached the animal kingdom will become extinct; whether, like an individual, it will die of old age? And here we must distinguish two questions. First, is it not possible that animals which have remained unspecialized during all times, should give rise constantly to new lines of development, and thus be a perpetual source of new forms? Second, will the present groups, after reaching their culmination, become extinct or simply remain stationary?

That there is a theoretical possibility of the origin of new types cannot be denied. New types, *i. e.*, new lines for specialization, can arise only from undifferentiated forms. But such undifferentiated forms still exist in great numbers. Even the most unspecialized form of all, the unicellular animals, are abundant enough, and in all groups we are acquainted with more or less generalized types. Theoretically, then, there is no reason why any of these forms should not expand itself and thus form an eternal source of new world forms. So long as the unspecialized forms do not become extinct, we cannot deny the possibility of an infinite number of future subkingdoms, which would, of course, make the animal kingdom an example of never-ending evolution.

But all of our evidence indicates that such a future is probably not a practical possibility, even though, as far as we can see, it may be a theoretical one. All biological studies point strongly to the conclusion that instead of several points of origin the animal kingdom has had only one. The subkingdoms have not arisen independently from the Protozoa, but have all had a common ancestor, the gastrula, and this means that only once has the unicellular form given rise to important lines of multicellular descendants. Though the Cœlenterata stand very near this primitive unspecialized form, there is no evidence that it has the power of further differentiation; but on the contrary, all tends to show that whatsoever differentiation of this simple type ever did take place, to give rise to the subkingdoms, occurred before the Silurian. Since palæontology shows us that no new great types have arisen since the Silurian, it is plain that all of the expansion of the simple unicellular form must have taken place before the Silurian. And coming through the later ages we find evidence the same in its tenor. The conclusion everywhere seems to be that when a generalized form has given rise to one or two lines of development, it either disappears or loses its power to originate new forms. Every step of palæontology carrying existing groups farther and farther back in the geological ages adds force to this general conclusion. Every bit of evidence which indicates a fundamental unity of the animal kingdom testifies to the same. Without questioning the theoretical possibility that any or all of the existing more or less unspecialized forms may in the future develop, we must acknowledge that the probability is against it. Nothing in history indicates that these groups retain power to expand, and there is, therefore, no reason for thinking it a possibility in the future. Remembering what a large number of groups we are learning to trace back to the Silurian, remembering that development has consisted, in the later geological ages, simply in the expansion of groups appearing long before, we must conclude that the power of the undifferentiated forms to expand into different lines of development disappears very early in their history. While then we cannot deny the possibility of an indefinite future development from the existing generalized types, it is certainly improbable that any new great groups will arise. Man, seizing upon the last undifferentiated faculty, the intellect, is developing this to extreme, and will probably be the last type to appear.

The second question, concerning the probability of the various groups becoming extinct after reaching their culmination, is not so easy to answer. It is certainly possible to conceive of them as remaining stationary at their culmination, neither developing further nor becoming extinct. Undoubtedly the history of the past shows that after any group reaches an extreme of specialization it does not remain stationary, but begins to decrease in numbers, finally to disappear. But the number of groups which have thus become extinct is not very great, and it is a question whether it is justifiable to claim that they really represent a general tendency. It is certain that disturbing causes which have acted in the past to produce extinction will grow less and less in the future. We can see that extinction in the past has been due to the inability of these extreme forms to adapt themselves to new circumstances with sufficient readiness. Of course when all of our present groups shall have developed themselves to extremes, they too will be unable to adapt themselves to new conditions, and would doubtless become extinct if they were called upon to meet adverse circumstances. But it is an acknowledged fact that physical changes are much less rapid now than they were formerly, and that they are constantly diminishing. If this is the case the developed extremes of the future will not be called upon to meet such changes in condition as those which have induced extinction in the past; and they may even then be able to undergo such slight modifications as will enable them to meet the slight changes in condition. Moreover, in the past extinctions have very generally occurred because animals have been unable to contend with the new and more vigorous forms which were capable of a more rapid modification than the older ones. But as we have seen, the number of possible new forms is constantly decreasing, and the time must come when it is no longer possible for new forms to arise to crowd the older ones out of existence. With almost stationary physical conditions, and with no new rivals, it may be that the animal kingdom is approaching a condition when, for reasons which we have seen, it cannot advance, and when there will be nothing to cause extinction, and it will therefore remain stationary.

There is one new condition, however, which is to have a prodigious influence upon the evolution of the future. The influence of man on the animal kingdom cannot be computed, but it

is probable that in many respects it will be a death blow to its evolution. Man is rapidly causing the extinction of almost all land animals, at least the larger ones. As the frontiers of civilization are being extended further and further into the uninhabited regions, he is driving out of existence all of the larger animals and many of the smaller ones. We have only to look ahead a comparatively short time to see the extinction of all land animals except such as man may preserve for his own use. To what extent this may apply to other animals, to insects, marine animals, etc., is not clear. But in the highest group of animals, the vertebrates, it is pretty clear that man is eventually to bring about not only the end of advance, but also the practical extermination of all animals except such as he especially preserves.

With all of these considerations together it seems perfectly plain that we must look upon the evolution of the animal kingdom as definitely limited and approaching an end. The tendency of specialization to advance to extreme limits, the impossibility of the further adaptation of these extremes to new conditions, the significant fact that no new forms of importance have arisen during all the later geological ages, the great influence of man in causing extermination of all sorts of animals, all these point to the same end. Just as evolution began in time, so it will end in time, and we must look upon the animal kingdom as progressing toward a limit. When this limit is reached, either there will follow a gradual extinction through a diminution of vital power, or if this be not the result, a stationary condition will ensue in which such animals as man has left in existence will remain unmodified until the progress of physical changes makes this world no longer habitable.

ANCIENT ROCK INSCRIPTIONS IN EASTERN DAKOTA.

BY T. H. LEWIS.

ON the celebrated map of I. N. Nicollet, of the "Hydrographical basin of the Upper Mississippi river," published by the U. S. Government in 1845, appear, for the first time, two strange names in Eastern Dakota, not far from the sources of the Minnesota river. The first is *Wakiyan Hurpi* (or thunder's—not lightning's—nest), placed about thirteen miles north-west of the foot of Lake Travers; and the other is *Wakiyan Oye*, a few miles west of the head of the same lake. The route followed by Nicollet, however, did not pass by either place, so he must have put them down from the general description of his guides, as he makes no mention of them in his text. It is of the latter locality, well known by its translated equivalent of "Thunder Bird's Track"—on account of the incised rocks there—that this article treats; together with another rock of like kind in the neighborhood.

In the month of August, 1883, I was engaged in the survey of the sepulchral tumuli, forts and other earth-works of Big Stone and Travers lakes, and thus being brought into the vicinity of the rocks in question, took the opportunity afforded of making careful tracings of the pictographs they showed, considering them of much archæological interest. These tracings have been reduced by pantograph to one-eighth the size of the originals, and drawings thus made from them accompany this short account of the "track rocks."

The first diagram shows the pictographs constituting "Thunder Bird's Track," as they are engraved on an irregular shaped rock located some six miles west and a little north of the village of Brown's Valley, Minnesota, and within the limits of the Sisseton and Wahpeton reservation of Dakota Territory. The rock lies on the summit of a hill which commands a good view of the country, though there are other hills in the vicinity which have a greater altitude. It is about three and a half feet in diameter, and the characters are grooved in its surface to about one-fourth of an inch in depth. The grooves are, for the most part, very smooth. It will be seen, however, that these figures do not make very good bird-tracks, and I think that they more probably rep-

resent human hands. For convenience of reference the separate characters are numbered on the diagram, and may be thus described.

1 and 2. Represent hands placed in different positions.

3. Shows two hands in combination.

4. Is of a nondescript shape.

5 and 6. Are undoubtedly meant for hands, as their outlines can be imitated in shadow on the wall by placing one's own hands in the proper positions.

7. Is another nondescript, though a portion of it represents a hand.

The other rock is known as "Thunder Bird's Track's Brother"—that is, a brother to the "track"—and is situated about two miles east of his elder, on the slope of a terrace bordering the valley of the Minnesota river. As will be seen on comparison, the diagrams illustrating the two rocks are entirely distinct from each other in respect to the shapes of the characters, and by no means bear out the close relationship between the localities implied by the names the Indians have given them.

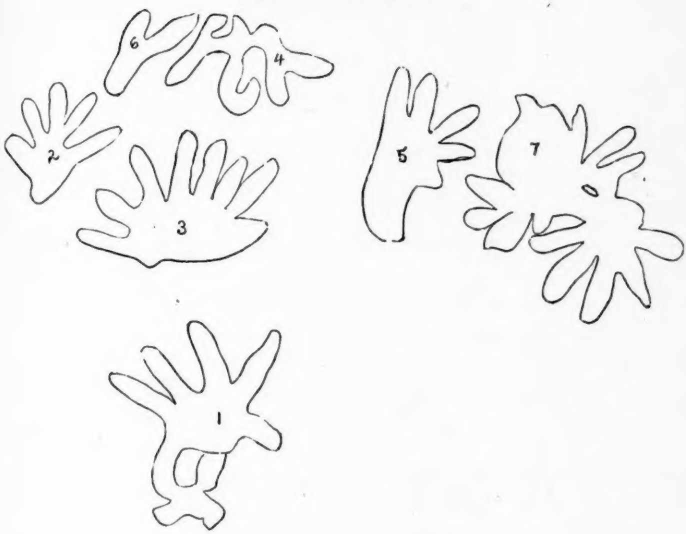
The inscriptions on both rocks are apparently very ancient, and it is extremely doubtful whether the present Indians or their immediate predecessors (the Cheyennes ?) had anything to do with carving them.

I made inquiry as to any traditions that might be current among the Dakota Indians on the reserve concerning these rocks, and obtained certain mythological information now concisely stated.

Thunder Bird is said to have had his nest on a high mound, which was composed of sticks and brush, and was situated some ten miles north-west of the foot of Lake Travers, in the center of a deep wide gorge. One day there was a great storm which flooded the whole country. Thunder Bird, in his anger at having been driven from his nest by the rising waters, flew away and alighted on this rock—*Wakiyan Oye*—which was the only place not covered by water, and left the impression of his feet there.

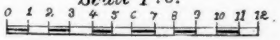
On subsequently looking for printed records of this tradition, the first account I could find of it was in the shape of a short poem from the pen of an Indian trader of 1823, W. J. Snelling (son of the military officer after whom Fort Snelling was named),

Thunder Bird's Tracks.



Thunder Bird's Tracks' Brother.

Scale 1.8.



Ancient Rock Inscriptions in Eastern Dakota.

which appeared in Griswold's Poets and Poetry of America (1842), and has been reprinted in Mr. Neill's histories. The last stanza but one has direct reference to the rock I have here first described, and runs thus:

> "Not long upon this mountain height
> The first and worst of storms abode,
> For, moving in his fearful might,
> Abroad the God-begotten strode.
> Afar, on yonder faint blue mound,
> In the horizon's utmost bound,
> At the first stride his foot he set;
> The jarring world confessed the shock.
> Stranger! the track of Thunder yet
> Remains upon the living rock."

——:o:——

VARIATION OF WATER IN TREES AND SHRUBS.

BY D. P. PENHALLOW.

THE amount of water which highly lignified plants contain, particularly as influenced by season and condition of growth, obviously bears a more or less important relation to physiological processes incident to growth, and most conspicuously to those which embrace the movement of sap. Studies relating to the mechanical movement of sap in early spring at once suggest the question as to how far this is correlated to greater hydration of the tissues at the time when this movement is strongest. It was with a view to exhibiting this relation more clearly, that determinations of moisture in a large number of woods, representing growth of one and also of ten years, collected at different seasons, were made in 1874.[1] The range of seasons was not as complete as could have been desired, and no attempt was made to formulate a general law applicable to this question. With a view to extension of data in this direction, additional estimates were undertaken in 1882, and it is the object of the present paper to combine all the results thus obtained, together with such other facts

[1] W. S. Clark. Agriculture of Massachusetts, p. 289.

as have come to our notice, and see how far they indicate a general law.

Theoretical considerations lead us to infer that if there is any variation at all, the hydration of structure must be greatest during the period of active growth, and least during the period of rest. How far this is supported by the facts will appear in what follows.

Hydration of Dead Wood.

Incidentally to the main question, specimens of dead wood, deprived of the bark and representing an age of from four to eight years, were collected and the moisture determined. While the branches were dead, none of them were in an advanced state of decay, so that the contained water could not be regarded as that of active decomposition, but simply that which would be readily retained in the lifeless, air-dried substance as exposed on the tree. The results obtained from fifteen species of trees showed an extreme variation of 6.1 per cent, the range being from 12.9 per cent to 19.0 per cent of water. The mean hydration obtained from these determinations was 15.1 per cent. The results appear in the following table:

HYDRATION OF DEAD WOOD.

Determined at 100° C.

Species.	*Per cent of water.*
Acer saccharinum	18.8
Amelanchier canadensis	19.0
Betula alba	15.1
" lutea	15.9
" lenta	13.7
Carpinus americana	13.8
Castanea vesca	14.0
Cydonia vulgaris	12.9
Cornus sericea	13.6
Pinus strobus	11.9
Pyrus malus	12.9
Prunus serotina	17.4
Quercus alba	15.5
Tsuga canadensis	18.6
Ulmus americana	13.5
Mean	15.1

Hydration of Wood from Living Trees.

The specimens upon which the principal facts in this paper are based, were collected as sections of living branches, representing on the one hand growth of two years, and on the other hand the growth of four years. For the obvious reason that the bark could not be properly separated from the wood with any degree of uniformity, it was left on in every case, so that in all the determinations here given the results show the combined percentage of water in wood and bark. Obviously this gives a result which differs materially from that which would be obtained if the wood and bark were considered separately. Also, while care was taken not to collect specimens in which the dead bark was strongly developed, thus securing as great uniformity as possible, the very fact that the bark was present, as well as the certainty of its variability in structural character, and thus also in hydration, as collected even from the same species at different seasons, rendered certain variations in the results unavoidable. This will doubtless appear upon examination of specific cases, but error from this source is reduced to a minimum in the aggregate, so that the mean results, in view of all the precautions taken, may doubtless be accepted as correct.

From an examination of the following results it will appear that, comparing the young growth with the older wood, the percentage of water is sometimes greater in one, sometimes greater in the other, conforming to structural peculiarities of the species and the relative preponderance of more or less strongly hydrated tissue. The mean results, however, clearly show what we might infer upon theoretical grounds, viz., that in the youngest growth, as also in the sap wood, the percentage of water is higher by two per cent than in the older growth, where the heart wood is in relative excess. This is found to hold true in the mean results not only for each season but also for all seasons; in the former case, however, the disproportion showing a variation from 0.8 per cent to 3.3 per cent.

	February.		*March.*		*April.*		*September.*		*December.*		*Means.*
	1st year.	2d year.	1st year.	2d year.	1st year.	2d year.	1st year.	2d year.	1st year.	2d year.	
Magnoliaceæ.											
Liriodendron tulipifera L.		55.8	52.7	54.9						59.3	44.5
Tiliaceæ.											
Tilia americana L.	55.1	53.9		55.6			48.6	55.9	53.2	58.1	54.3
Rutaceæ.											
Ailanthus glandulosus Desf.	48.6	46.0									47.3
Anacardiaceæ.											
Rhus glabra L.			45.6	41.1					41.2	36.4	41.1
" typhina L.			51.3								51.3
Vitaceæ.											
Vitis cordifolia Michx.	42.1	41.7	48.3	48.0					48.8	43.7	45.4
Ampelopsis quinquefolia Michx			59.2	60.7					76.4	62.4	64.6
Ilicineæ.											
Ilex verticillata Gray			46.2	46.4					48.0	49.4	47.5
Celastraceæ.											
Celastrus scandens L.			47.7	49.4					52.3	52.4	50.4
Rhamnaceæ.											
Ceanothus americana L.			17.3	37.6					19.5	41.4	28.9
Sapindaceæ.											
Acer saccharinum Wang.	46.5	47.1	47.5	42.9			48.1	44.0	42.6	42.7	45.2
" rubrum L.	44.9	44.7	50.8	45.4		48.7			53.0	55.1	48.9

Æsculus hippocastanum L.	49.1	46.1									47.6
" flava Ait.							64.9	65.4			65.1
Leguminosæ.											
Gleditschia triacanthus L.	34.9										34.9
Robinia pseudacacia L.			44.0	38.3					51.3		44.5
Rosaceæ.											
Amygdalus persica L.	46.1	40.4	50.9	49.4	56.0	43.7			55.3	42.0	47.9
Prunus domestica L.			48.1	41.2					53.9	46.2	47.4
" serotina Ehrhart			52.7	50.8			50.6	50.3	47.3	46.0	49.6
" cerasus L.			49.9						50.6	47.7	49.4
Cydonia vulgaris L.	45.5	39.6					56.3	52.6			48.5
Pyrus communis L.	49.9	47.7	49.7	48.1	55.4	54.0	54.0	51.5	53.7	50.0	51.4
" malus L.	49.5	44.8	45.7	41.5	49.0	46.4	56.2	54.5	48.3	59.	48.8
Amelanchier canadensis Torr. & Gray	44.3	38.0		44.6					47.4	45.1	45.9
Cratægus tomentosa L.			43.1	40.4					55.9	43.4	45.7
Hamamelaceæ.											
Hamamelis virginica L.	41.7	41.1	48.2	54.2					48.7	51.3	44.2
Cornaceæ.											
Cornus florida L.			55.1	43.2					53.6	52.8	51.2
" sericea L.			50.6	49.2			55.4		51.2		51.6
Nyssa multiflora Wang.	50.9	49.0	48.0	49.3			51.1	50.9	50.8	58.7	52.2
Caprifoliaceæ.											
Sambucus canadensis L.			58.2	48.2					56.3	55.1	54.4
" pubens Michx.	54.5	55.7									55.1
Viburnum opulus L.	44.7	47.7									46.2
Rubiaceæ.											
Cephalanthus occidentalis L.			54.1	42.8					42.8		46.6
Ericaceæ.											
Andromeda ligustrina Michx.			46.7	45.9					38.0	59.0	47.4
Kalmia latifolia L.		42.5	50.7	44.4					49.4	42.3	45.8
Azalea nudiflora L.			41.8	43.8					45.8	49.9	45.3

	February.		*March.*		*April.*		*September.*		*December.*		*Means.*
	1st year.	2d year.	1s year.	2d year.	1st year.	2d year.	1st year.	2d year.	1st year.	2d year.	
Oleaceæ.											
Fraxinus americana L.	32.0	29.6	38.3	34.4					35.2	29.5	33.2
Thymeleaceæ.											
Dirca palustris L.	51.8										51.8
Lauraceæ.											
Sassafras officinalis Nees.	34.9	33.9	40.7	38.1						41.4	37.8
Solanaceæ.											
Lycium barbarum L.									65.4	58.0	61.7
Urticaceæ.											
Ulmus fulva Michx			52.1	44.0					51.5	36.3	45.9
" americana L	41.4	39.8	45.6	36.8			57.1	52.3	43.0	43.9	44.9
Morus alba L.	52.1	43.0									47.5
" rubra L.			47.0	42.8					56.2	40.9	46.7
Platanaceæ.											
Platanus occidentalis L.	44.5	57.6	50.2	52.1	52.5	53.8			48.2	50.6	51.2
Juglandaceæ.											
Juglans nigra L.	45.5	46.1	50.2	56.1					50.6	53.8	50.4
" cinerea L.			50.5	52.2			54.2	54.1	49.5	50.4	51.8
Carya alba Nutt.			39.2	40.2			45.7	45.1	38.4	37.8	41.1
" porcina Nutt.			40.8	38.0					38.1	35.4	38.1
" amara Nutt.	33.3	31.2									32.3

Cupuliferæ.											
Quercus alba L.	38.0	35.2	40.6	38.7	41.2	36.7	43.1	39.5	45.0	41.9	39.9
" bicolor Willd.			45.0						46.9		45.9
" coccinea v. tinctoria Wang.			42.5	38.0					44.9	39.3	41.2
" ilicifolia Wang.			40.6	39.4					42.2	38.4	40.4
" palustris Du Roi			43.2	39.8					44.8	39.9	41.9
" prinus v. monticola Michx.			42.4	37.9					42.4		40.9
" rubra L.		34.3	42.6	38.6					41.7	39.9	39.4
Castanea vesca L.			47.4	45.6					45.1	44.5	45.6
Fagus ferruginea Ait.	44.2	44.7	45.4	45.7					45.2	45.8	45.2
" sylvatica v. purpurea.			43.8	43.3					43.7	43.5	43.5
Corylus americana Walt.			49.8	48.6					50.9	52.8	50.5
Ostrya virginica Willd.	37.6	38.6	43.0	36.5					44.4	44.5	40.8
Carpinus americana Michx.	38.7	39.4	45.6	42.8			51.7	48.7	44.5	43.9	44.4
Myricaceæ.											
Comptonia asplenifolia Ait.	40.6	40.0									40.3
Betulaceæ.											
Betula lenta L.			44.9	38.9					44.7	41.5	42.5
" lutea Michx.	42.4	43.6		38.2			49.7	49.4	44.4	42.5	44.5
" alba v. populifolia Spach.	46.2	42.0	41.1	37.7			53.9	48.5	45.0	39.1	44.4
Alnus viridis D.C.			47.9	43.2					48.9	55.0	48.8
" incana Willd.	50.4	51.5									50.9
Salicaceæ.											
Salix-alba v. vittelina L.	49.9	51.7	55.5	55.5			53.1	49.7	55.4	55.5	53.3
Populus tremuloides Michx.	49.8	50.9	47.9	52.5			53.3	51.0	52.8	51.5	51.2
Coniferæ.											
Larix europea L.	40.9	47.8									44.3
Juniperus virginiana L.			57.6	45.9					56.2	45.1	51.2
Tsuga canadensis Carriére	48.7	49.6	46.8	49.9					44.1	45.6	47.4
Pinus rigida Miller.			54.2	52.3					53.8	57.6	54.5
" strobus L.			58.8	52.1	56.3	55.5	62.9	58.3	63.1	51.6	57.2

If we next inquire into the relation which seasons bear to the contained water, we will observe that the percentage continually rises from the mid-winter period until spring, and that it again falls from the close of summer to the mid-winter period. The extreme variations, as exhibited in our figures, show between February and September a difference of 8.4 per cent for the youngest growth and 7.1 per cent for that which is older.

MEAN HYDRATION OF WOODS.

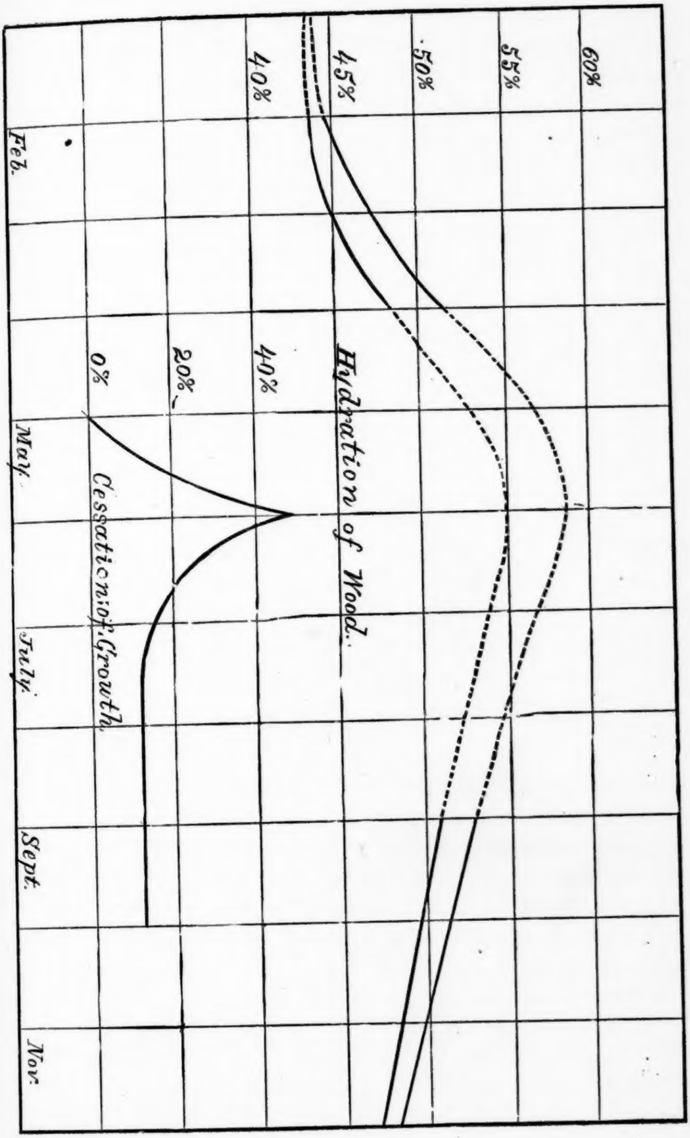
Determined at 100° C.

Months.	*Per cent water.*		*No. for average.*	
	1st year.	2d year.	1st year.	2d year.
February	44.7	43.9	37	38
March	47.2	44.8	59	60
April	51.7	48.4	6	7
September	53.1	51.0	19	18
December	48.3	47.2	61	58
	49.0	47.1	36.4	36.2

Our figures also indicate that the maximum hydration of the tissues must occur either in September, or at some period intermediate to this month and April. By graphic representation of these results, it will become possible to determine with approximate accuracy the true period at which this maximum is reached. The figures show that from February to April, the rate of percentage increase is much more rapid than the rate of percentage decrease from September to December, showing that the maximum must fall nearer the former than the latter period.

A properly constructed curve will show all of these relations. By reference to the accompanying diagrams it will be seen that the curves for both young and old wood run nearly parallel, but that they tend to approach at their greatest depression, or the mid-winter period, and to more widely separate at their greatest altitude, during the spring period. It is also seen that from mid-winter to spring, the curve rises rapidly, and reaches its greatest elevation about the last of May for the young wood, that which is older possibly reaching its maximum a few days later. From this time on the curve descends at a more gradual rate until December, when it suddenly drops to its minimum depression, which evidently occurs in January.

PLATE XVII.



60%
55%
50%
45%
40%
Hydration of Wood.
40%
20%
0%
Cessation of Growth.
Feb.
May.
July.
Sept.
Nov.

Periods for Cessation of Growth.

As upon theoretical grounds the tissues contain most water when the growth is most active, data which will enable us to accurately fix the limiting periods for the season's growth, will have an important bearing upon this question. Mr. W. E. Stone,[1] accepting the completion of terminal buds as marking completion of the longitudinal growth for the entire year, has obtained the following data as establishing the limiting periods of growth for the latitude of West Point, N. Y., 41° 23′ N.:

JUNE 1ST.

Acer saccharinum Wang.
" *rubrum* L.
Amelanchier canadensis Torr. & Gray.
Carya alba Nutt.
Fagus ferruginea Ait.
Fraxinns americana L.
Hamamelis virginica L.
Kalmia latifolia L.
Populus tremuloides Michx.
Quercus alba L.
" *bicolor* Willd.
" *coccinea* Wang.
" *prinus* v. *monticola* Michx.
Sambucus pubens Michx.
Tilia americana L.
Ulmus americana L.
" *fulva* Michx.

JUNE 15TH.

Betula lenta L.
Carpinus americana Michx.
Castanea vesca L.
Juglans nigra L.
Lindera benzoin Meissn.
Morus rubra L.
Ostrya virginica Willd.
Prunus cerasus L.

JULY 19TH.

Andromeda ligustrina Muhl.
Alnus incana Willd.
Nyssa multiflora Wang.
Staphylea trifolia L.

INDETERMINATE PERIOD.

Ampelopsis quinquifolia Michx.
Celastrus scandens L.
Rhus sp.—
Vitis sp.—

Growth in length having ceased at these periods, the energy of the plant then becomes directed to the lignification of tissues and the deposition of reserve material for growth the following year. These changes, however, of necessity involve a continual decrease in the contained water. The data above also show that the majority of plants complete their longitudinal growth within the first six weeks of the growing season; that most of these complete their growth in from three to four weeks; and that, as the season advances, the number of plants still growing, rapidly diminishes until the middle of July, after which time there are left but few, those being plants like the grape, which continue to grow until arrested by severe cold.

Bull. Torrey Bot. Club, XII, 8, 83.

A graphic representation of these changes in connection with the curves of hydration, will enable us to determine the relation of growth and seasons to hydration of tissues. This comparison will show most conspicuously that that period at which growth for the season is chiefly terminated, is nearly coincident with the period of maximum tissue hydration, the former being but five or ten days later than the latter.

From the foregoing facts the following appear to be the general laws:

1st. The hydration of woody plants is not constant for all seasons, and depends upon conditions of growth.

2d. The hydration reaches its maximum during the latter part of May or early June, and its minimum during the month of January.

3d. Hydration is greatest in the sap wood; least in that which is older.

4th. Greatest hydration is directly correlated to most active growth of the plant; lignification and storage of starch and other products being correlated to diminishing hydration.

These facts apply only to latitudes lying between New York and Boston. For other latitudes, certain modifications might be necessary.

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DOMESTICATION OF THE GRIZZLY BEAR.

BY JOHN DEAN CATON, LL.D.

THE family of bears is among the most widely distributed groups of the quadrupeds, and is represented by a number of living species. They occupy the polar regions of the north and the temperate and torrid regions of both hemispheres. Some are of enormous strength and fierceness, others are diminutive and comparatively mild in disposition. Nearly every species has been held in captivity in considerable numbers, yet of their adaptability to domestication but little of real scientific value has been written, and I think I may add but little is known, for the want of judicious experiment and careful observation.

They are sometimes met with in the streets in various countries, exhibited by street showmen, who have taught them various amusing tricks, evincing considerable intelligence and docility,

but these are generally of the smaller and milder species, and but little of their training or domestication has been recorded.

Those which have been exhibited in gardens or menageries, as a general rule, are merely held in confinement, and not in domestication, so that little can be learned from them of their adaptability to complete subjection to human control. This can only be learned by long-continued experiments and observations under favorable circumstances by those whose tastes and inclinations fit them for the task.

My attention was called to this subject by reading the "Adventures of James C. Adams," who was a celebrated hunter of California, who seems to have had a genius for capturing and domesticating wild animals. Among others he fairly domesticated quite a number of the grizzly bear (*Ursus ferox* Lewis and Clark) with complete success. This is the largest and fiercest known of all the species, and it might be expected the most intractable or unsubmissive to human control, yet such appears not to have been the case.

The first specimens experimented with were two cubs, over a year old when caught, taken in Washington Territory, between Lewis and Clark's fork of the Columbia. They were brother and sister; the latter was retained by Adams, and his experiments were principally conducted on her, which he called " Lady Washington." She seems to have been the more tractable and submissive. The male he parted with to a friend, after he had received but the rudiments of his education. At first they were chained to trees near the camp-fire, and resisted all attempts at familiarity and kindness; then severity was adopted, until they finally submitted.

Soon after the male was parted with, and we have no account of his subsequent career. The female was always after treated with the utmost kindness, and in a few months became as tractable as a dog. She followed her master in his hunting excursions, fought for him with other grizzlies, and saved him from the greatest perils.

She slept at his feet around the camp-fire, and took the place of a most vigilant watch-dog. He taught her to carry burdens with the docility of a mule, and as she grew up her great strength enabled her to render him great assistance in this way.

Another bear of the same species he captured in the Sierras in

California, before its eyes were open, and raised it on a grayhound bitch in company with her own pup. This he called Ben Franklin, and proved more docile even than the first. He never found it necessary to confine in any way this specimen, but he was allowed to roam and hunt with his foster brother, the grayhound. They were inseparable companions, and seemed to have as much affection for each other as if they had been of the same species. Before he was full-grown, when his master was attacked by a wounded grizzly, he joined in the fight with such ferocity as to save his master's life, and though he was severely wounded in this contest, with careful nursing he survived, and ever after showed as much courage in attacking his own species as if he had not met with this severe punishment.

He seems to have had less confidence in Lady Washington, for she was generally kept chained during the night and when on the journey, though allowed to follow free when on the hunt. This may be explained by the fact that she was over a year old when captured, while the other never had any taste of wild life.

When she was chained up near the camp-fire in the Rocky mountains, she was visited several nights by a large wild bear, which her master refused to disturb, and she, in due time, bore a cub, which grew to maturity under the tuition of her owner, and which he called Fremont, which he says manifested considerable intelligence and sagacity, but not equal to that of his dam or to his favorite, Ben Franklin. It is to be regretted that exact dates are not given from which we can determine precisely the period of gestation, but by comparing all the dates that are given, it may be stated provisionally that that period was nine months.

It has been stated by good authority that no instance has been known of any member of the bear family having bred in domestication, and this is the only instance where I have found such an event recorded or heard it stated.

Our author raised many of these animals, but generally disposed of them before they reached maturity, but he gives us no particulars except in these two instances.

He found the black bear, when raised in camp, as readily domesticated as the grizzly, and as fond of his society, following him about the camp and through the woods with fidelity and attachment.

It is certainly interesting to observe how completely the savage nature of these ferocious animals was overcome in those which were born in a wild state, and it would be interesting to know what modifications might be made in succeeding generations by domestication, an experiment which could only be successfully tried under favorable conditions, which do not exist with the great number of animals of this genus now held in confinement. I may remark here a wide difference in the effect of domestication upon the disposition of this animal and many others, which in the wild state show no ferocity, but only timidity. Take the Cervidæ, for instance, when brought up by hand; they lose all fear of man; they develop a wickedness and ferocity never manifested in the wild state; while the bears, so terrible when untamed, show docility, constancy and affection when brought into close familiarity with man. They seem to appreciate his kindness and care, and repay it with attachment and devotion, while the other class of animals, which are not ferocious by nature, seem to be entirely unappreciative of kindness, or at least seem incapable of continued personal attachment to the hand that feeds them.

When I first read Mr. Adams' adventures, I considered it an interesting romance, or at least that it was largely embellished by an ingenious imagination, but upon inquiry in San Francisco, I met reliable persons, who had known him well, and had seen him passing through the streets of that city, followed by a troop of these monstrous grizzly bears unrestrained, which paid not the least attention to the yelping dogs and crowds of children which closely followed them, giving the most conclusive proof of the perfect docility of the animals. Indeed, they were so well trained that they obeyed implicitly their master's every word or gesture in the midst of a crowded city, with surroundings which we might suppose would have aroused their native ferocity, if that were possible. After the most careful investigation I became convinced of the reliability of the narrative, and as the facts our author gives are interesting to science, I venture to repeat them, regretting, however, that he did not appreciate the great value of his observations, since he might have given us more particulars which must have come under his observation; but so it is that a vast majority of those who have good opportunities for observing do not know how to observe judiciously, or do not record their observations.

Mr. A. S. Kent, of San Rafael, California, who for many years, on account of his health, spent several months each year in camp life in the mountains, principally hunting the deer, informed me that he once purchased a couple of cubs of the grizzly bear, which he took into camp with him. One of these proved very docile and tractable, and seemed fond of his attention and society, and usually slept contentedly at his feet. The other seemed possessed of a much more vicious disposition, and he was obliged to kill it. Possibly this might have been overcome by patient care and judicious training.

There is no doubt that different dispositions among these animals as among most other, may be met with.

Mr. Kent's observations tend, in some degree at least, to confirm those of Mr. Adams.

May we not hope that some one with the necessary taste and proper facilities will try experiments and give us the benefit of their observations?

A complete monograph of any one of our species of bears under all conditions would be a valuable addition to our zoölogical literature.

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ON THE NATURE AND ORIGIN OF THE SO-CALLED "SPIRAL THREAD" OF TRACHEÆ.

BY A. S. PACKARD.

WHILE we owe to Professor O. Bütschli the discovery of the mode of origin and morphology of the tracheæ, which as he has shewn[1] arise by invaginations of the ectoblast; there being originally a single layer of epiblastic cells concerned in the formation of the tracheæ; we are indebted to Professor A. Weismann[2] for the discovery of the mode of origin of the "intima," from the epiblastic layer of cells forming the primitive foundation of the tracheal structure. We are also indebted to Weismann for the discovery of the mode of origin of the terminal tracheal cells.

Weismann did not observe the earliest steps in the process of formation of the stigma and main trunk of the tracheæ, which Bütschli afterwards clearly described and figured.

Weismann, however, thus describes the mode of development

[1] Zur Entwicklungsgeschichte der Biene. Zeit. wissen. Zoologie, XX, 519, 1870.
[2] Die Entwicklung der Dipteren im Ei. Zeit. wissen. Zoologie, XIII, 1863.

of the intima; after describing the cells destined to form the peritoneal membrane, he says: "The lumen is filled with a clear fluid and already shows a definite border in a slight thickening of the cell-wall next to it.

"Very soon this thickening forms a thin structureless intima, which passes as a delicate double line along the cells, and shows its dependence on the cells by a sort of adherence to the rounded sides of the cells (Taf. VII, 97 A, *a b c*). Throughout the mass, as the intima thickens, the cells lose their independence, their walls pressing together and coalescing, and soon the considerably enlarged hollow cylinder of the intima is surrounded by a homogeneous layer of a tissue, whose origin from cells is recognized only by the regular position of the rounded nuclei (Taf. VII, fig. 97 B).

"Then as soon as the wavy bands of the intima entirely disappear and it forms a straight cylindrical tube, a fine pale cross striation becomes noticeable (VII, 97, B, *int*), which forms the well-known 'spiral thread,' a structure which, as Leydig has shown, possesses no independence, but arises merely from a partial thickening of the originally homogeneous intima.

"Meyer's idea that the spiral threads are fissures in the intima produced by the entrance of air is disproved by the fact that the spiral threads are present long before the air enters. Hence the correctness of Leydig's view, based on the histological structure of the tracheæ, is confirmed by the embryological development, and the old idea of three membranes, which both Meyer and Milne-Edwards maintain, must be given up."

Weismann also contends that the elastic membrane bearing the "spiral thread" is in no sense a primary membrane, not corresponding histologically to a cellular membrane. On the contrary, the "peritoneal membrane comprises the primary element of the trachea; it is nowhere absent, but envelops the smallest branches as well as the largest trunks, only varying in thickness, which in the embryo and the young larva of Musca stands in relation to the thickness of the lumen."

The trachea, then, consists primarily of an epithelial layer, the "peritoneal membrane" or the invaginated epiblast; from this layer an intima is secreted, just as the skin or cuticle is secreted by the hypodermis. We may call the peritoneal membrane the *ectotrachea*, the intima or inner layer derived from the ectotrachea

the *endotrachea;* we hope to show that the so-called "spiral thread" is not spiral in arrangement but simply thickenings of the endotracheal membrane, parallel to each other, not necessarily continuous nor arranged in a spiral manner. For these chitinous bands we would suggest the name *tænidia* (Greek, little bands).

Our observations have been made on the larva of a species of *Datana*, which was placed in alcohol, just before pupation, when the larva was in a semi-pupal condition, and the larval skin could be readily stripped off. At this time the ectotrachea of the larva had undergone histolysis, nothing remaining but the molted endotrachea, represented by the tænidia, which lay loosely within the cavity of the trachea. The ectotrachea or peritoneal membrane of the pupa was meanwhile in process of formation; the nuclear origin of the tænidia was very apparent, and it was their appearance which led me to examine the origin and mode of development of the so-called "spiral thread," and to endeavor to trace its relations to the intima (endotrachea) and peritoneal membrane (ectotrachea).

Fig. 1 is a longitudinal section through a secondary tracheal branch, showing the origin of the circular chitinous bands, or tænidia. At *t'* are pieces of six tænidia which have been molted; *ectr* are the nuclei forming the outer cellular layer, the ectotrachea or peritoneal membrane. These nuclei send long slender prolongations around the inside of the peritoneal membrane; these prolongations, as may be seen by the figure, become the tænidia. The tænidia, being closely approximate, grow together more or less, and a thin endotracheal membrane is thus produced, of which the tænidia are the thickened band-like portions. The endotracheal membrane is thus derived from the ectotrachea, or

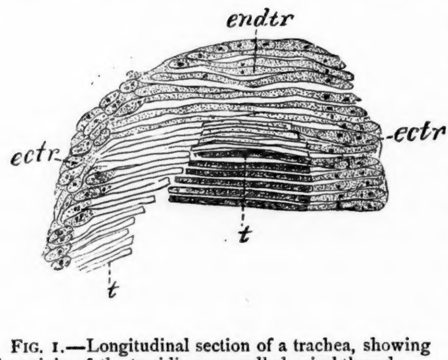

FIG. 1.—Longitudinal section of a trachea, showing the origin of the tænidia or so-called spiral thread.

primitive tracheal membrane, and the so-called "spiral thread" is formed by parallel thickenings of the nuclei composing the secondary layer of nuclei, and which become filled with the chitin secreted by these elongated nuclei. The middle portion of the tænidia, immediately after the molt, is clear and transparent, with obscure minute granules, while the nuclear base of the cell is filled as usual with abundant granules, and contain a distinct nucleolus.

The origin of the tænidia is also well shown by Fig. 2, which is likewise a longitudinal section of a trachea at the point of origin of a branch. The peritracheal membrane or ectotrachea (*ectr*) is composed of large granulated nuclei; and within are the more transparent endotracheal cells; at *t'* are fragments of the molted tænidia. The new tænidia are in process of development at *t;* at base they are seen to be granulated nuclei, with often a distinct nucleolus, and sending a long slender, transparent, pointed process along the inside of the trachea. These unite to form the chitinous bands or so-called spiral threads.

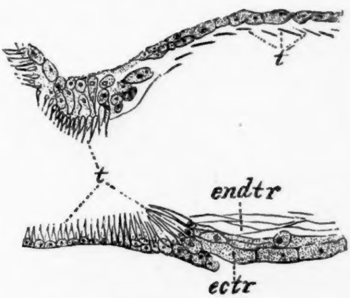

FIG. 2. Origin of the tænidia.

The tænidia I have found to be separate, independent, solid rings, more or less parallel and independent of each other. The supposed spiral arrangement I believe to be an optical illusion. The tænidia of a main branch stop at the origin of the smaller branches, and a new set begin at the origin of each branch. This fact also shows conclusively that the chitinous bands are not spiral. Nor do the tænidia at the origin of the branch pass entirely around the inside of the peritoneal membrane; in the axils they are short, separate, spindle-shaped bands.

The tænidia are usually thin, flat, but often slightly concavo-convex, the hollow looking towards the center of the trachea. I have been unable to find any forming incomplete hollow rings or tubules, like the pseudotrachea of the fly's tongue figured and

described by Professor G. Macloskie.[1] It seems to me that the function of the tænidia is like that of the cartilaginous rings of the tracheæ of vertebrates, *i. e*, to keep the air-passage open so that the air may pass to the cells at the end of the trachea. All the figures of the spiral thread hitherto published I believe to be incorrect. In Guyon's work on *Pulex penetrans* they are represented to form a loose spiral, and so they appear at first glance under a low power in the tracheæ of the common flea of the cat. But on close examination, in an excellent preparation, the so-called spiral thread is a series of independent parallel tænidia, the spaces between them being wider than usual. In Fig. 3, from a prepa-

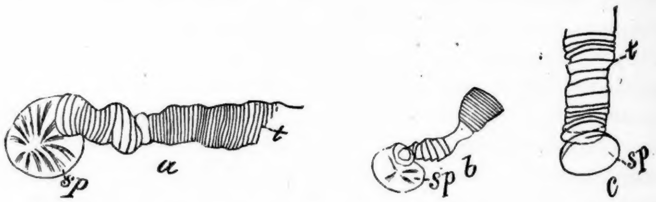

FIG. 3.—Stigma and trachea of Pulex.

ration kindly presented to me by Mr. Justin Spaulding, *a* represents one of the first abdominal spiracles and the trachea arising from it; *b* the fifth; and *c* one of the last abdominal spiracles and its trachea. When the trachea bends or contracts in diameter the tænidia become less parallel, and a spiral appearance is produced. In the last pair the tænidia are remote from each other.

In a preparation of one set of the salivary glands from the head of the honey bee, given me by Mr. Spaulding, the common duct is much like a trachea, having similar tænidia, and here they are observed to be parallel, independent bands.

The sections of Datana were made for me by Professor H. C. Bumpus of Olivet College.

[1] Thus far I find myself unable to agree with Professor G. Macloskie that the "spirals of the proper tracheæ" are "crenulated thickenings of the intima," or that the tænidia are really tubular. In his valuable and suggestive article, "The Structure of the Tracheæ of Insects (AMER. NAT., XVIII, 567), I believe he has demonstrated the true nature of the pseudotracheæ of the fly. His criticisms of Chun's views and figures I believe, in the main, to be correct, but thus far I am unable to convince myself that the "external fissure" of the tænidia in the figure he copies from Chun, whose original essay I possess, is really such; it appears to be a new tænidium in process of formation previous to molting.

EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

—— In our issue of June of last year we referred to certain conditions of membership of the National Academy of Sciences in the following terms: "In the interval between the annual meetings of 1884 and '85 two members of a committee appointed to investigate a question affecting one of the bureaus of which they themselves are employees, were requested to resign from the committee by the chief of the bureau in question. This was in obedience to a rule that a department of the Government can not be criticized by its subordinates. It requires no argument to show that if this rule be carried out with reference to the Academy of Sciences, its usefulness as an independent body is at an end. There is also another danger which flows directly from the same or a similar attitude on the part of heads of bureaus. These gentlemen by filling up the academy with their employees can obtain practical control of its decisions. This would be immensely convenient to them under various circumstances, but it would introduce an element of corruption into the academy from which it has been hitherto happily free, and which would deprive it of the respect and confidence of the country."

In the case first cited the bureau's action would indicate an apprehension of hostile criticism, perhaps judging from the characters of its employees who had been appointed to investigate. In the latter case reference was made to a case where the bureau concerned did not ask its employees to resign, since it evidently did not fear any adverse report as a result of their investigation. In this case some of the members of the committee appointed by the president of the academy to coöperate with the committee of Congress in the investigation of the scientific bureaus, were employed by some of the bureaus at high salaries. There are a good many men who, under such circumstances, would be unable to perceive any necessity for changes in the administration of their bureaus.

The position of the academy in relation to these matters although at present unavoidable, is, to say the least of it, unfortunate. And the situation of its members is reduced to utter helplessness in consideration of the manner in which committees are appointed and are permitted to report. That is, they are appointed in the interval of the academy's meetings by the president alone, and make their reports without the supervision or criticism of the

academy, which only hears of them at the next meeting as a matter of history! The academy is thus made responsible for any report that a committee of paid employees of a department may choose to make respecting that bureau. The situation is such that no member of the academy can wish it to continue. The reflections which the world can justly make on its position ought not to be possible.

As a remedy for this fundamental evil, we propose the following changes in the constitution of the academy:

1. Not more than one-half of the members of the National Academy shall be paid employees of the Government.

2. The president of the academy shall be selected from those members who are not paid employees of the Government.

3. Committees selected to report on the efficiency of a Government bureau, shall not embrace any employees of that bureau.

4. The committees shall be selected by the president and council, which shall also approve the reports of committees before they are sent to Congress.

5. The members of the council who are not such *ex officio*, shall be selected from the different classes of the academy as follows: One from the anthropological class; two from the biological; two from the physical; and one from the applied class.

6. For convenience of reference and selection the membership of the academy shall be divided into four classes as follows: Anthropology, embracing philosophy, pure mathematics and anthropology in the limited sense; Biology, including the biological sciences and psychology; Physics, including astronomy, physics, chemistry and geology, without palæontology; and Applied science. The proportion of membership of each should be .15 p. c., .35 p. c., .35 p. c., and .15 p. c.

7. In order that the members of the academy shall be more or less independent of Government places, they should be salaried; $1000 per annum for members; $1500 for members of the council, and $5000 for the president.—*C.*

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RECENT LITERATURE.

The Annals of the Cakchiquels.[1]—The Cakchiquel tribe of Indians forms one of the more interesting portions of the Maya stock of Central America; their territory extends at present from Lake Atitlan, Southern Guatemala, to the east and thence to the south down to the Pacific. The ruins of their former center and

[1] *The Annals of the Cakchiquels.* The original text, with a translation, notes and introduction. By Daniel G. Brinton, M.D. Philadelphia, 1885, 8vo, VI and 234 pages. (Forms No. 6 of the editor's Library of Aboriginal Literature.)

capital, Iximché, are situated in the Department of Chimaltenango. Owing to their agricultural pursuits, to the healthy climate and the consequent density of population, these Indians, as well as some other Maya nations, developed a higher culture, material and mental, than many other neighboring populations of Southern Mexico, Honduras, etc. Many tracts of Guatemala contain sculptures and architectural remains of these gifted tribes, attesting no mean degree of civilization, and this they must have acquired by slow progress long before the Spanish conquest. Under the Spanish domination several of the more enlightened Indians applied themselves to gathering and writing down the legends and historic traditions of the people, moved by patriotism and by the desire of preserving their national antiquities. One of these monuments is the Popul Vuh, written in Kiché; another is the book now before us, worded in Cakchiquel, a dialect differing from Kiché about as much as Spanish does from Portuguese. The manuscript was called by Brasseur de Bourbourg, "Mémorial de Tecpan Atitlan," but Dr. Brinton has substituted the more appropriate title, "Annals of the Cakchiquels." The original forms a volume of forty-eight leaves or ninety-six pages, intended to figure as a document in a lawsuit to reobtain or secure landed property belonging to the ancient family of tribal rulers, the Xahila. This legal instrument included in its plea the full history of the tribe and the genealogy of the Xahila family, to make their claim more valid, and it had several members of that family for its authors. They wrote it in Atitlan in the course of the sixteenth century, and only the historic or first portion of it is printed in the volume before us. The precious manuscript became the property of the late Abbé Brasseur, and with his collection finally passed into the hands of Mr. Alphonse L. Pinart, who loaned it to Dr. Brinton for publication. Assisted by natives the learned Abbé had made a tentative French translation of the document, and in perfecting it he was materially aided by the then extant Spanish translations of some select portions. The document is authentic and of high ethnographic value. Let us now examine how Dr. Brinton has acquitted himself of the task of editing, translating and commenting it.

The missionary, F. de la Parra, who died in 1560, introduced into the Cakchiquel alphabet five un-Spanish letters or signs to represent certain "cut" sounds[1] of that dialect. These occur also in the Xahila manuscript; Brinton reproduces four of them, rendering the fifth by *tz*. These bold, black-faced characters no doubt impart to the book an air of erudition; but Dr. Stoll in his grammatic sketch of Cakchiquel replaced them by apostrophed consonants, and Dr. Brinton might have done the same. At any rate it is puzzling to see that they do not appear also in the proper names of the English translation opposite. One of these

[1] Sounds followed by a short stop of the voice.

letters, the *cuatrillo*, Brinton often transcribes by *q*, but when he should write *Baqahola* he writes *Bagahola* (p. 67).

Cakchiquel never became a literary language in our sense of the term, and consequently its orthography was never regulated by anything like steady principles. In the "Annals" the orthography is about as unsettled as can be. Now in editing texts of this description, the first thing to do is to adopt scientific principles deduced from and consistent with the character of the language; to introduce a correct, logical punctuation, to separate the prefixed pronouns from their verbs or nouns, *if separable*, to make compound words conspicuous as such *at sight*, and to unite the tense and modal signs with the verb into one word. *On the lower margin the editor has to indicate all the readings of the original for which he introduces emendations*, according to his system, *into the text*. Of a similar proceeding Brinton has no conception whatever, for he reproduces the most flagrant incongruenties, which every school-boy might easily correct, in his text. Thus he writes: qui bi, and in other places quibi, *their names* (p. 66), chu kahibal and chukahibal, *at the setting* (p. 68), Iximche and Yximchee (name of the capital, with the old-fashioned Spanish *y* for *i*, p. 166), qari instead of qa ri, *and they* (p. 68), and many other instances sufficient to perplex the student. Besides this, Brinton has also "doctored" the manuscript by introducing text-readings of his own, for in the introduction (p.63) he says: "I felt myself free to exercise in the printed page nearly the same freedom which I find in the manuscript." He did so, undoubtedly, not only in the Indian text, but also in French quotations from Brasseur, in which he shows himself fearfully at variance with the accepted French accentuation: p. 197, and still more on p. 206. On p. 206 the term *l'œuvre* is twice written *l'euvre*. Neither has the proof-reading been thoroughly attended to; p. 168 we find Yaxontik, and in the translation Yaxonkik; p. 107, Vookaok, a proper name, which is spelt voo kaok on p. 110; p. 66, mahaniok, *before;* in the vocabulary the same term is spelt mahanick.

After all this we are not much surprised at the punctuation of the Indian text, for where there is, and ought to be, a period in the translation, Brinton often has a comma or *nothing at all* in the text. On p. 66 paragraph third is subdivided into 1, 1, 0, where he has 1, 2, 3 in the translation. It takes just as much time to study Brinton's "system" of editing and, as he calls it, his "freedom in the printed page," as it does to acquire the whole of the Cakchiquel language, which cannot by any means be called a very difficult one.

While professing to disagree in many passages with the Abbé's translation, the merits of which he otherwise fully acknowledges, the editor sometimes attempts a better one, and gives his motives for doing so in the Notes, pp. 195–208. Being thus bent on correcting, he nevertheless renders ixkaqahol (p. 67 and often) by

oh my children, when the correct sense is: *you our children.* On pp. 176, 177 he omits in the translation the whole sentence: *tok xbokotah chiqa el Qeche vinak* (§ 145), because he could not find in his dictionaries the original form of the verb xbokotah. Likewise are omitted from the translation opposite the words rahpop achi Ig'ich, *and the counselor Ig'ich.* No gap or empty space was left in the translation to remind the reader of an omission, as fairness would have prompted every common-sense editor to do; neither do Brinton's " Notes " give notice of any omission having been made consciously. Students confiding *in the translation alone* might thus get cheated out of very important facts stated in the Indian original. It would be interesting to find out whether Brinton made any such " omissions " from the original also; in that case passages would be left out in the text as well as in the translation.

In comparing the small compass of the vocabulary contained in pp. 209–227 with the bulky text, which holds not less than sixty pages, our curiosity becomes aroused to some degree. For how could the large number of terms composing the texts become enclosed within so small limits, although there is a separate index for proper names? Further examination easily reveals the fact, that vuo-o, voo, *five*, a numeral often occurring in the text, is *not* in the vocabulary; ahauh, *ruler*, is there, but the verb *to rule*, of which xahauar (p. 87) is a conjugational form, is not there; we fail to find there: petebal, navipe, onohel, g'anel (the name of a *month*) of the text; for *pa* the definition *from* is omitted, though referred to in the " Notes." Tok is probably the same as tak, though we get no information on this point; g'ana (p. 68), though translated by *glorious*, is not recorded. The different forms of one word produced by alternation of sounds are referred to in a few instances only. In view of this neglect to enter *all the words* of the text into the collection, which Brinton was bound to do, we understand why he used the term *vocabulary* and not the otherwise more appropriate term *glossary* to designate it.

For the comprehension of a text in a foreign language we naturally have to enlighten ourselves on its grammatic elements. Suppose a reader gets hold of the " Annals " in some remote corner of Russia or India and wishes to study them not from the botchy translation only, but from the text itself, he finds no chapter on the grammar of Cakchiquel in the volume, except on phonetics, but is referred by Brinton to the Grammar " which he has for sale." The chief elements of inflection at least should be contained in the book, as prefixes, suffixes, verbal inflection, word-composition, etc. Of all this we find incidental notices in the " Notes," but nothing that could serve for grammatic guidance. Brinton's above-mentioned " Grammar " consists of two old grammars united into one volume, one of the seventeenth and the other of the eighteenth century. They will prove of

help to students, undoubtedly, but of what help they will be, can be gathered from a remark of Dr. Otto Stoll, who studied the tongue on the spot. He states (Zur Ethnographie Guatemalas, p. 139), that Cakchiquel possesses three tenses only, and that the three or four others given by the Spanish missionaries do not exist, but were "squeezed out" of the natives by the application of Latin models. The verb lok' (p. 146) which supplied paradigms to the unfortunate grammatic attempts of the Padres to conjugate *amare, to love*, does not signify *to love* at all, but *to purchase*. The verb *to prize, to hold dear, to esteem*, is not, as falsely quoted by Brinton (p. 216), lok', but lok'oj (Stoll, p. 147). Or did the language change as much as that within the last two hundred years?

In the Introduction, p. 9, the editor states that the three Maya nations more closely related to the Cakchiquels: the Quichés, the Tzutuhils and the Akahals "dwelt respectively to the west, the south and the east of the Cakchiquels." Had he looked up the matter in Stoll's map and in the map of the Grammar *published by himself*, he would have noticed that the Kichés lived, and still live, upon a much larger territorial extent, north, west and partly south of the Cakchiquels, and that the Tzutuhils are enclosed on all except the western side by Cakchiquel settlements.

In the long list above, the mistakes and shortcomings were quoted from a *few* pages of the book only, and readers may decide for themselves how numerous the errors may be for the other nineteen twentieths of the volume. It was edited on false principles, and here as elsewhere the editor was too much in a hurry to appear before the public. Books like these require the prolonged, discriminating and plodding work of a mind concentrated upon itself. To render this text of use to science, Mr. Pinart, proprietor of the original and himself a linguistic scholar educated at German universities, should republish the chronicle and the still wanting *family record* after scientific principles, adding a correct and full translation and a complete glossary together with a variety of grammatic and ethnologic notes forming a *commentarius perpetuus*. This is the only way to do justice to this important document, now so piteously "doctored up" by the rudest kind of malpractice.—*A. S. G.*

REPORT OF THE NEW YORK AGRICULTURAL EXPERIMENT STATION.[1]—It does not speak well for the kind of work generally done upon the agricultural experiment stations of this country that readers of scientific journals do not expect to find in them reviews of the annually published reports. Agriculture has been cursed by a greater amount of very poor work under the name of exper-

[1] *Fourth Annual Report of the Board of Control of the New York Agricultural Experiment Station for the year 1885.* With the reports of the director and officers. Transmitted to the Legislature January, 1886. Rochester, N. Y., E. R. Andrews, printer and bookbinder, 1886.

imentation than any other of the great industries. Dealing as it does with the soil, the atmosphere, plants and animals, one would suppose that careful and expensive experiments would invariably be confided to men trained in one or more of the great modern sciences—chemistry, physics, botany, zoölogy, geology, meteorology. That such has, however, not been the case, is shown by an examination of the reports which have appeared with more or less regularity ever since the agricultural colleges and agricultural departments of the State universities were organized. With here and there an exception, such reports have contained nothing which were of any value to a scientific investigator in any field whatsoever.

The report of the New York Agricultural Experiment Station for the year 1885 is noteworthy in several ways, not the least important of which is its early appearance, the copy under review having reached us early in February. Its contents are full of valuable matter covering nearly the whole field of agriculture in its widest sense. We can take time here for but a hasty glance at a few of the more important topics.

The results of duplicate plantings (p. 37) are suggestive. In the case of Indian corn differences in yields equivalent to from two to fourteen and fifteen bushels per acre were obtained from similar plats treated in the same way. Of similar significance are many of the duplicate germinations of seeds (p. 54).

In the germination of seeds to determine the influence of age (p. 58), much greater quantities were taken than is customary, the usual number here being some hundreds, often reaching several thousands. Results obtained in this way are much more satisfactory. The same precautions enter into the temperature experiments upon germinations of Indian corn (p. 64), and in the latter case some very useful results have already been reached.

Of a very different nature, but still of high scientific interest, are the following, viz., a study of maize, being an attempt at forming a new variety (p. 73); variations [of Indian corn] from seed (p. 74); the characteristics of wheat varieties (p. 90), being a systematic classification and arrangement of many varieties; improvement in selecting (p. 107), a bit of work such as Darwin delighted in; a description of the principal varieties of lettuce (p. 137), a systematic classification and arrangement; observations on growth, character and depth of roots p. 233).

The botanist's report (pp. 241–265) deals with pear blight, the spotting of quince fruit, the rotting of tomatoes, lettuce-rust, lettuce-mildew, the rotting of cherries and plums, the disease of the clover-leaf weevil, weeds and their fungous parasites. It is needless to say that this work has been well and carefully done.

In the chemist's report, among many other interesting topics may be particularly mentioned a study of the fat globules of milk, the lysimeter observations, the records of sunshine, and the

digestion experiments, in which artificial digestion is resorted to in order to determine the value of feeding-stuffs.

The whole report is one of which the board of control may well feel proud, and we trust that the director and his corps of able assistants may be enabled to continue with increased facilities the lines of investigation so excellently begun.—*Charles E. Bessey.*

SCHMIDT'S MAMMALIA IN THEIR RELATION TO PRIMEVAL TIMES.[1]—Although Dr. Schmidt, who has died since the publication of this book, was not a special student of the mammals, he was the author of a useful work on comparative anatomy, and well fitted by his general studies for preparing the present interesting sketch. The book is mainly of interest to the American student for its discussion of the fossil mammals of the old world. It is very much behind the times as regards our knowledge of American extinct mammals, as much light has within two or three years past been thrown on the subject by the publications of Cope and of Marsh, particularly the recent generalizations of the former author, which appeared in this journal during 1884 and '85. The extract from Schmidt's book, which appeared in our department of geology and palæontology, shows his mode of treatment of the subject. Equally interesting is his account of the evolution of the pigs, the deer, and especially the oxen. The discussion as to the ancestry of the whales is an interesting one, Schmidt favoring Flower's view that they are an offshoot from the ungulate mammals.

As to the origin of the monkeys and apes, Schmidt suggests that the American group may have descended from the Insectivora, and the old world forms, with the apes, from the Pachydermata, certainly a novel view. As to the origin of man from such a source, he thinks we are justified in postponing any such discussion, "as the study of anthropology can in no way boast of having made any definite progress during the last ten years."

GEIKIE'S CLASS-BOOK OF GEOLOGY.[2]—This is an excellent piece of work, both literary and scientific. In very readable form, with most excellent illustrations, paper and press-work; it is a pleasure to turn over the pages. Everything has been done to make the book and subject attractive to the beginner. We have looked with most care over the early part of the volume, for in physical geology the author is at his best. His treatment of rocks and minerals is excellent, better than anything we know of published in this country; it is so clear simple and attractive. The woodcuts being also unusually well drawn and engraved.

We are a little disappointed with the fourth part on historical

[1] D. Appleton & Co., New York. $1.50.

[2] *Class-book of Geology.* By ARCHIBALD GEIKIE, LL.D., F.R.S. London, Macmillan & Co., 1886. 12mo, pp. 516.

geology. It is scarcely adapted for use in this country, though valuable for reference. The illustrations are mainly of European fossils, and the treatment is rather meager and dry compared with the other portions of the book; the classification adopted is in some points not fresh, and the entire treatment is not what is now wanted.

The *Eophyton linnæanum* is figured as though it were a plant; the *Ceratiocaris* is still referred to the phyllopod Crustacea; the Tunicata are still retained with the brachiopods in that mysterious collection called "Molluscoidea." These, however, are slight defects. But palæontology cannot be set forth in its truest light by one who has not done practical work in biology and palæontology.

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GENERAL NOTES.

GEOLOGY AND PALÆONTOLOGY.

THE PLAGIAULACIDÆ OF THE PUERCO EPOCH.—Three species of this marsupial family have been thus far detected in the beds of the Puerco. These are *Ptilodus mediævus* Cope, Vol. III, Report U. S. Geol. Surv. Terrs., p. 173, Pl. XXIII*d*, Fig. 1; *P. trovessartianus* Cope, l. c., p. 737, AMERICAN NATURALIST, 1885, 493; *Neoplagiaulax americanus* Cope, AMER. NATURALIST, 1885, p. 493. Of these the last-named species is the largest, the lower jaws representing an animal of the probable size of the Norway rat. I am now able to add a fourth species to this list in a second species of Neoplagiaulax, much larger than the *N. americanus*, and hence the largest species of the family known. It is established on an entire inferior fourth premolar. The length of the base of this tooth is one third greater than that of the corresponding tooth of the *N. americanus*, and there are fifteen keel-crests on the side of the crown, while there are but seven in the *N. americanus*. The outline of the crown is of the elongate and moderately convex character of that of the *N. americanus*, and thus not so elevated as in our species of Ptilodus. The irregularity in the outline of the base of the crown is less than in the other species, and the diameter of the roots is subequal. The anterior base of the crown is not excavated for the fourth premolar as in the species of Ptilodus. Length of base of crown 16^{mm}; elevation at middle, 8^{mm}. The discovery of species of this family of increased size was to have been anticipated, in view of the dimensions of the *Thylacoleo carnifex*, which was no doubt descended from the Plagiaulacidæ. I call the animal *Neoplagiaulax molestus*.—*E. D. Cope.*

"LIST OF THE GEOLOGICAL FORMATIONS OF SPITZBERGEN."—The article with the above title, printed in the last December number of the AMERICAN NATURALIST from a manuscript which

eight years ago I handed to one of the editors of this journal, had well needed a revision before its late publication. As however no opportunity was given me to revise it, I beg to add the following emendations, based on the late discoveries by Dr. Alfred Nathorst, in the expedition under his charge in 1882.

The *Cretaceous system* should be stricken out from the list, the beds previously supposed to belong to this system being *Jurassic* of a higher horizon than the "No. 1, upper beds" at Cape Boheman. The fossil plant determined as *Sequoia reichenbachii* belongs to another genus of conifers, allied to Araucaria.

The *Permian system* should be added to the list, beds of this system existing everywhere on the Ice fiord and Belsound between the Carboniferous and Triassic beds.

In the *Carboniferous system* the "1, upper beds" should be omitted from the list; they are identical with "3, ursastuffe," but placed on the top of "2, calcareous beds" by an inversion which had been overlooked by previous explorers.

The existence of the *Devonian system* on Spitzbergen is no longer doubtful. Nathorst has found, on Dickson bay, and E. Ray Lankester described, characteristic fossils, *e. gr.*, Scaphaspis and Cephalaspida.—*Josua Lindahl.*

NICHOLSON ON STROMATOPORIDÆ.— H. A. Nicholson, in his monograph of the British Stromatoporoids, frankly accepts the views of Carter, Lindström, Zittel and others as to their cœlenterate affinities, and regards them as a special group of the Hydrozoa, having on the one hand relationships with Hydractinia, on the other with Millepora. The skeleton of the typical Stromatoporæ is penetrated by numerous minute flexures, but essentially parallel vertical tubes, not bounded by distinct walls, but enclosed by the vermiculate fibers of the cœnosteum, precisely like the zoöidal tubes in Millepora. These tubes are traversed at intervals by calcareous plates. A detailed comparison between *Hydractonia echinata* Flem., and forms of Actinostroma Nich., shows a remarkable similarity between the chitinous skeleton of the first and the large calcareous cœnosteum of the second. Our author arranges the group in four families, two of which, Actinostromidæ and Labechiidæ, are Hydractinoid, while the Stromatoporidæ and Idiostromidæ may be regarded as Milleporoid. The last family contains genera which have a central, axial, tabulated tube without proper wall, giving off lateral branches, which also divide.

FOSSIL HIPPOPOTAMI.—Dr. Henry Woodward, in a review of the species of Hippopotamus, shows that at least two species (*H. major = amphibius*, and *H. minutus*, and probably identical with *H. liberiensis*) occurred in Europe in late Tertiary and early Quaternary time, while four species are known from India. *H. pentlandi*, the bones of which are exceedingly abundant in Sicily,

is by Mr. Woodward (agreeing with Professor Boyd Dawkins) considered to be identical with *H. minutus* from the caves and fissures of Malta.

The Indian species are *sivalensis*, *iravaticus* and *namadicus* from the Siwalik hills, and *palæindicus* from the Narbadas.

MINERALOGY AND PETROGRAPHY.[1]

Mineralogical News.—The late Dr. Lasaulx, of Bonn, recently examined[2] very thoroughly the mineral corundum with reference to its microstructure and optical properties. The fact that sections of this mineral cut perpendicular to the vertical axis often show a biaxial interference figure in converged polarized light has been known for some time. Lasaulx attempts to find the cause of this. Sections of crystals from nine localities were carefully made and thoroughly studied. In summing up the results of his examinations he concludes that (1) corundum is undoubtedly a uniaxial mineral, crystallizing in the hexagonal system; (2) the anomalies in optical properties are due to irregularity in growth; (3) this irregularity in growth often gives rise to a zonal arrangement in which the different zones are in twinning position to each other, the twinning planes and planes of growth being identical; (4) the optical anomalies are due in some cases to tension in the individual zones. Compression obtained in a direction normal to their greatest extension in the base; consequently the plane of the optical axes is parallel to this direction of the lamellæ; (5) in other cases where the different lamellæ are twinned, optical disturbances are produced; finally (6) decomposition may give rise to aggregate polarization. ——Orthoclase has been found for the first time as a druse mineral in leucite-tephrite.[3] In the cavities of this rock were found crystals of phillipsite, calcite, orthoclase (adularia), altered pyrite and calcite again, in a regular order of deposition. The adularia occurred in groups covering the phillipsite and also in perimorphs of calcite. Crystals of the latter mineral were covered with a druse of adularia, and showed under the microscope a rim with aggregate polarization, as if the calcite substance were gradually being replaced by adularia.——In an article on göthite,[4] Ed. Palla declares as a result of a series of measurements on crystals from Cornwall, that the mineral is either orthorhombic with the axes $a:b:c = .9163:1:.6008$, or monoclinic with $\beta = 90° 36' 25''$ and $a:b:c = .9164:1:.6008$. If the former view is taken the planes $\infty \breve{P} \frac{02}{100}$, $\infty \bar{P} \frac{100}{52}$, $\infty \bar{P} \frac{102}{50}$, $\frac{102}{100} \breve{P} \frac{102}{100}$, $\bar{P} \frac{102}{100}$ and $\bar{P} \frac{100}{52}$ must be considered as vicinal; whereas if the mineral is considered as monoclinic these (with the exception of the first) become $\infty P \frac{100}{52}$, $P \frac{100}{52}$

[1] Edited by W. S. Bayley, Johns Hopkins University, Baltimore, Md.
[2] Zeitschrift für Krystallographie, x, p. 346.
[3] V. von Zepharovich. Zeitschrift für Krystallographie, x, p. 601.
[4] Zeitschrift für Krystallographie, xi, p. 23.

$- P, + P, - \breve{P}_2$. Thin plates parallel to the cleavage are translucent to transparent with very weak pleochroism if any. The positive bisectrix is probably perpendicular to the cleavage plane. The dispersion very large, $\upsilon > \rho$, so that for red light the mineral is uniaxial. For green and blue light, however, the optical angle is about 50°. In all its optical properties it resembles rutile very closely.——In attempting to prove by means of etched figures[1] that cryolite is without doubt a monoclinic mineral, Baumhauer[2] has succeeded in showing that in the massive mineral two crystals are so united that (1) ∞P and oP of the one are parallel respectively to ∞P and oP of the other; or (2) ∞P of the first is parallel to oP of the second, and *vice versa.*——Crystals of struvite with a different habit from any heretofore described have been found at Homburg v. d. H., and investigated by Kalkowsky.[3] The planes observed were $P\breve{\infty}$, oP, $2P\breve{2}$, $2\breve{P}\hat{\infty}$, $\infty P\breve{\infty}$, $P\bar{\infty}$ and $\infty P2$. In physical properties the mineral from this locality also differs from that found elsewhere, $a : b : c = .5685 : 1 : .9113$. The acute bisectrix is the macrodiagonal. The crystals are hemimorphic with oP the analogue pole.——Friedel,[4] of München has analyzed pure staurolite from Framnitzberg, and found it to correspond to the formula $H_4 (Mg\ Fe)_6 (Al\ Fe)_{24} Si_{11} O_{66} = (Mg\ Fe)_6 Al_6 (Al\ O)_{18} (O\ H)_4 (SiO_4)_{11}$, in which the oxygen ratio is 2 : 1.——Doelter[5] has recently succeeded in effecting the synthesis of several minerals of the group of the sulphides and sulpho-salts by the use merely of those reagents which exist naturally, and at a temperature much lower than that usually employed in such experiments. Pyrite was obtained in crystals by the action of sulphuretted hydrogen on hematite at a temperature of 200°, and also by the action of an aqueous solution of the same reagent on siderite and magnetite, in sealed tubes at 80°–90°. Galena was obtained by heating together cerussite and an aqueous solution of hydrogen sulphide in a sealed tube to the same temperature. Crystals of cinnabar, covellite, chalcocite, bornite, chalcopyrite, bournonite, miargyrite and jamesonite were all obtained by methods analogous to one or the other of these, and in no case was a high temperature required. The results are of considerable interest as affording a ready means of explaining the origin of some of the most common minerals we have to do with.——Messrs. Friedel and Sarasin[6] recently heated together a mixture of precipitated calcium carbonate and a solution of ten grams of calcium chloride in 60–70^{cc} of water in a stell tube lined with platinum. After ten hours heating at 500° the mixture was

[1] Cf. AMERICAN NATURALIST, 1886, February, p. 158.

[2] Zeitschrift für Krystallographie, XI. p. 133.

[3] Ib., XI, p. 1.

[4] Ib., X, p. 366.

[5] Ib. XI, p. 29.

[6] Bulletin de la Société Minéralogique, July, 1885, p. 304.

found to contain little rhombohedra of calcite. With twenty grams of calcium chloride rhombohedra were obtained, which gave on measurement an angle of $105° 46'$. Several experiments were made, but in no case was any aragonite formed. ——Hæmostilbite is described by Igelström[1] as a new mineral from the iron mine of Sjoegrufvau, Grythyttan parish, Sweden. It is of a blood-red color by transmitted light, and is found in a gangue of tephroite in fissures with calcite, in a bed of limestone in granulite. An optical examination by Bertrand proved the mineral to be orthorhombic. The acute bisectrix is negative and is perpendicular to the easy cleavage. The optical angle is small and the dichroism very pronounced. In hardness and general appearance it approaches haussmannite. An analysis yielded:

Sb_2O_3	MnO	FeO	Mg(Ca)O
37.2	51.7	9.5	1.6

This composition is represented by the formula, 8MnO, Sb_2O_5, or 9MnO, Sb_2O_5, which is very near that of another mineral already described under the name of manganostilbite, with which the hæmostilbite may be identical.

Petrographical News.—A very interesting article has just appeared in the Beilage Band of the Neues Jahrbuch,[2] on the geological and petrographical relations of the porphyries of the Central Alps. In it the author, C. Schmidt, describes the massive rocks of the Grosse and Kleine Windgälle. Among the Jurassic schists an iron-oölite was found. This consists of a reddish limestone containing oölites composed of magnetite, both massive and crystallized, in a groundmass of calcite and hematite, with a rim of a green fibrous mineral which the author thinks might be the chamosite of Bertier. The crystalline rocks are principally gneisses, hornblende rocks (including a peridotite and a porphyritic rock composed of large aggregates of hornblende in a coarse-grained plagioclase in which is also a large amount of augite in smaller granular aggregates) and quartz porphyries, which are divided into five types. As a result of the pressure to which these porphyries have been subjected, some of them are found to pass over into a completely schistose rock in which the original constituents can be traced under the microscope by means of their alteration products. From a study of the granitites and porphyries from other localities in the same region, Schmidt concludes that the Windgälle rock is either a facies of granite or a distinct rock mass, and that it is not possible to declare positively which of these is really the case. The paper is well illustrated by a map and five sections.——Michel Lévy has

[1] Bulletin de la Société Minéralogique, June, 1885, p. 143.

[2] Neues Jahrb. für Mineralogie, etc., Beil. Bd., IV, 1886, p. 388.

recently examined[1] a rock from the left bank of the Jamma, a tributary of the Blue Nile. This rock consists of the remains of orthoclase of the first generation in a groundmass of secondary quartz with little crystals of nepheline, orthoclase and amphibole. It is, according to Lévy, a type of rock between the tephrites and the phonolites.——In the same journal Lacroix has a note[2] on the basaltic rocks of County Antrim, Ireland. These are labrador basalts with a typical ophitic structure. They contain the following minerals in the order of their crystallization: apatite, magnetite, olivine, labradorite and pyroxene in lathe-shaped crystals, palagonite, hematite, chlorite and zeolites. The zeolites are in the cavities of the rock. A search was made for the native iron mentioned by Andrews as occurring in these rocks, but none was found.——Four additional parts of the "Erläuterungen zur geologischen Specialkarte des Königreichs Sachsen"[3] have just been published. The sections described are Oschatz-Mügeln by Th. Siegert, Falkenstein by Schröder, Wurzen by Schalch and Auerbach-Lengenfeld by Dalmer. These authors describe the Eibenstock tourmaline granite, the Kirchberg granitite and the slates and sandstones metamorphosed by them.

MISCELLANEOUS.—The Denison University of Granville, Ohio, has just issued, in its Bulletin of the Laboratories of Denison University, a compendium of petrographical manipulation by C. L. Herrick. The first part is a condensation of the theoretical part of Hussak's book, in which many of the errors of the original have been rectified. The methods in use for the preparation and examination of rock section are described as clearly as might be expected in a treatise of such small size. Unfortunately a few mistakes still remain to confuse the student who attempts to make use of this little work without the aid of an instructor to explain away his difficulties. Most of these errors, however, seem to be due to too much hurry on the part of the composer. On page 132, for instance, the axes of elasticity are spoken of as optical axes. The second part is a translation of Hussak's tables. It is safe to say that in the hands of a consciencious teacher this little pamphlet of Mr. Herrick's will prove of great value to students who desire merely to gain some insight into the methods so generally made use of at present in the study of rocks.

BOTANY.[4]

CARBONACEOUS RESERVE FOOD-MATERIALS IN FUNGI.—M. L. Errera points out in the Comptes Rendus of the French Academy of Sciences a close analogy in this respect between fungi and flowering plants. In the seeds, tubers, &c., of Phanerogams

[1] Comptes Rendus, CII, No. 8, p. 451.
[2] Ib., 454.
[3] Cf. AMERICAN NATURALIST, April, 1886, p. 374.
[4] Edited by Professor CHARLES E. BESSEY, Lincoln, Nebraska.

the food-material may be stored up either in the form of starch, inulin, &c., on the one hand, or in that of oil on the other hand. Exactly the same difference is observable in fungi, substituting only glycogen for starch or inulin. The great reservoirs of food-material in fungi are the sclerotia. The sclerotia of *Claviceps purpurea* contain oil, those of *Coprinus niveus*, *Peziza sclerotiorum*, &c., glycogen, while in other cases the food-material is accumulated, as in some seeds, in the form of thickenings of the cellulose-walls.

When sclerotia which contain glycogen germinate, the glycogen gradually decreases, while it accumulates in the growing fungus, in the stipes, pileus and lamellæ, into which it appears to pass directly from the sclerotium. In the germination of the sclerotia of ergot the oil rapidly disappears and is replaced by glycogen, which is, however, only of a temporary persistence, soon disappearing, and again making its appearance in the part when the fructification is subsequently formed. This resembles closely the phenomena which attend the germination of oily seeds like those of Ricinus and Cucurbita. Transitory glycogen is also formed in the germination of the spores of many fungi.—*A. W. Bennett.*

HENSLOW'S STUDIES OF EVAPORATION OF WATER FROM PLANTS.—In December, 1885, the Rev. George Henslow read a paper before the Linnean Society entitled, "A contribution to the study of the relative effects of different parts of the solar spectrum on the transpiration of plants," which is of such interest that we reproduce its more essential parts. After reviewing the work of other observers the author describes his method of work, which consisted in using glasses of different colors:

"The plan I finally adopted was to grow small plants in miniature pots two inches high and nearly two inches in diameter. These can be entirely wrapped up in gutta-percha sheeting, which is carefully bound round the stem of the plant with cotton-wool within and around the stem. This effectually prevents any evaporation from the surface of the earth or pot; and all loss of weight is due to the transpiration from the exposed surface of the plant alone.

"My experiments were made upon lettuce, box, Echeveria, small seedling palms, ferns, cactus and many other kinds of shrubs and herbs; having selected them with very various degrees of density in the epidermis, as well as of different families. The results would seem to entirely corroborate the conclusion of Weisner, that transpiration is mainly effected by the red, blue and violet rays, while the (optically) brightest rays of yellow and green are generally less able to effect it, *even if they do not hinder it.* I emphasize this sentence, as there appear to me to be grounds for coming to such a conclusion, as will be seen hereafter."

After detailing his experiments the following is given as the conclusion: "The above experiments, selected from a large series, seem to me to abundantly prove that Weisner's results are correct; and while recognizing the fact that obscure heat-rays cause a certain amount of the loss of water by evaporation, that transpiration *per se* (theoretically distinct from the purely physical process of evaporation, which takes place from all moist surfaces and bodies, dead or alive) is especially, if not solely referable to those particular bands of light which are absorbed by chlorophyll, and that such light, being arrested, is converted into heat, which then raises the temperature within the tissues and causes the loss of water. The only additional fact which I have here advanced, somewhat tentatively, is, that yellow light has a *retarding influence* upon transpiration, for the reasons given above. That 'life' has a retarding influence upon evaporation as distinct from transpiration, I think my experiments (which I hope to continue hereafter) have distinctly proved."

It will puzzle any one to make out a good reason for using two terms for the process of water-loss in plants. We have it said that "evaporation" is the "purely physical process," while the experiments show that what is called "transpiration" is, after all, a physical process also; and when we are told, as in the last sentence above, that "life has a retarding effect on evaporation," the confusion of ideas becomes somewhat embarrassing. Why not use but one term, and that the more general one—evaporation? The fact of modification or control of evaporation is so common a phenomenon in nature that we cannot regard it as of great significance. Common salt or sugar added to water retards evaporation.

The mutual attraction of the molecules of cellulose and water retards evaporation; so does the mutual attraction of the molecules of protoplasm and water. Heat increases the rate of evaporation, while a reduction of temperature (other things being equal) retards it, etc., etc. Why not call the loss of water in the plant what it is—evaporation, and then discuss the several modifying influences? Certainly such a course would contribute to clearness and accuracy, and would relieve the beginner of one of the difficulties in vegetable physiology.—*Charles E. Bessey.*

ELLIS AND EVERHART'S NORTH AMERICAN FUNGI.—The sixteenth and seventeenth centuries of this valuable distribution of dried specimens of the fungi were sent out early in March. With the fifteenth century the first series of centuries closed, and in order to mark its termination Mr. Everhart prepared an alphabetical index to all the species. The first fifteen centuries were published by Mr. Ellis, but now with the beginning of the new series the name of Mr. Everhart appears upon the title-page and the labels. As Series I included fifteen centuries, we may confidently hope that Series II will carry the work up to thirty centuries!

The centuries before us are largely devoted to the Sphæriaceæ and the so-called "imperfect fungi." The genus Cercospora is represented in Cent. XVI by twenty-five species, many of which have been but recently described. Septoria is represented in Cent. XVII by sixteen species, Sphærella by eleven.

We trust that this important work, which must be largely a labor of love, will go on to the completion of the second series, so happily begun.

Botanical News.—From the Transactions of the Institute of Natural Science of Nova Scotia we have a paper on the Canadian species of the genus Melilotus, by Professor George Lawson.——The eleventh annual report of the American Postal Microscopical Club contains a couple of pages of suggestive botanical notes from the "note-books" of the club.——Superposed buds are discussed by Aug. F. Foerste in a late number of the Bulletin of laboratories of Denison University. The paper is accompanied by a plate.——Dr. Farlow's paper on Biological teaching in colleges, published in the March number of the *Popular Science Monthly*, will be read with interest by every teacher of the "laboratory method" in botany.——The March *Journal of Mycology* contains descriptions of the species of Phyllosticta, Claviceps and Cordyceps, and also a sketch of the life and labors of the botanist Schweinitz, the latter accompanied with a portrait.——The March number of *Grevillea* is accompanied by pp. 113 to 128 of the new edition of Cook's Hand-book of British Fungi. Thus far the descriptions include 456 species, all of the genus Agaricus.——Late numbers of *Flora* contain an important paper, Zur Systematik der Torfmoose, by Dr. Röll of Darmstadt. The "collective species," with their numerous varieties and forms, are fairly bewildering, and strongly suggest the inadequacy of the Linnæan nomenclature.——The Bulletin of the Torrey Botanical Club has been much improved the present year. Its Index to recent American botanical literature is now one of its most valuable features. In the February number L. H. Pammel publishes a paper on the structure of the testa of several leguminous seeds, accompanied by two plates.——In the March *Botanical Gazette* D. H. Campbell describes the development of the root in *Botrychium ternatum*, and J. N. Rose contributes an article on the mildews (Erysiphei) of Indiana. The June number of this invaluable journal is to be devoted to field and herbarium work, and hence will be of particular interest to collectors.——Henry Holt & Co., of New York, announce for early publication a Hand-book of plant dissection, by J. C. Arthur, C. R. Barnes and J. M. Coulter.

ENTOMOLOGY.

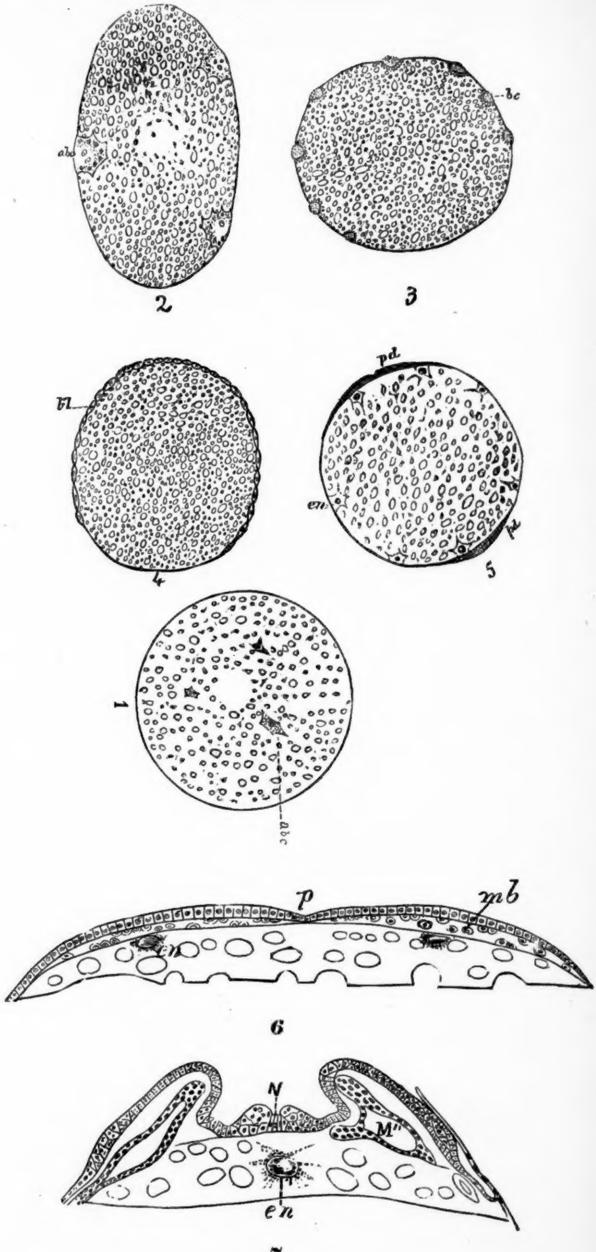
Development of the Mole Cricket.—A. Korotneff has published in the Zeitschrift für wissen. Zoologie, xli, 4, 570, a well illustrated essay on the embryology of the mole cricket, which has been also noticed by C. Emery in the Biologisches Centralblatt for Jan. 15, in connection with Grassi's observations on the development of the honey bee. The egg of the mole cricket has an abundant yolk, while that of the bee has little yolk and is small and transparent. Yet both observers have independently arrived at the same results in four important points. It is noteworthy that in both forms before the formation of the blastoderm a stage was observed in which the amœboid embryonal cells seemed to possess no clear nuclei. With this result might be connected the relation briefly described by A. Sommer in the case of a Podurid, when the ripe egg was entirely without a nucleus. Whether there was in all these cases a genuine absence of the nucleus, or a diffuse nucleus form, such as Graber discovered in the Protozoa, is still to be determined, and would not be without interest in connection with the late reflections of Weismann and others on heredity.

In Gryllotalpa the embryonic cells are at first scattered over the surface of the egg; some migrating into the deeper parts of the yolk and forming the yolk cells regarded by Korotneff as the primary mesoderm. From the ectoderm exclusively separates the endoderm. There first originate, under the ectoderm cells which Korotneff denotes as mesenchym, and not till later does the separation of the myoblasts follow along the ventral median line. Later still arise from the ectoderm near the tracheæ other groups of cells which are also to be considered as mesenchym, and which were also observed in Bombyx by Tichomiroff.

The embryonal membranes serosa and amnion arise as ectodermal folds. After the limbs are indicated the segments are formed. Korotneff enumerates eighteen segments, *i. e.*, four in the head, three in the thorax, ten abdominal and one tail-segment (Tichomiroff observed the same number in Bombyx. The nervous system primarily shows a corresponding organization in seventeen pairs of ganglia, which are reduced to thirteen by the consolidation of the three hinder head-ganglia (in the text they are erroneously called thoracic ganglia) and the three last abdominal ganglia. The cerebral ganglia are first separated from each other and only joined to the ventral chain by slender commissures. The structure called "chorda" by Nusbaum is a median ectodermal one, which grows in between the two series of ganglia, and has nothing at all to do with the formation of the connective tissue of the nervous system. This last tissue must arise from the immigrating blood-cells.

Especially interesting are the observations on the structure of

PLATE XVIII.



the entoderm and digestive canal. The cells of the primary entoderm (the yolk cells) undergo a radial division of the yolk, the yolk-pyramids thus arising melting into each other centrally. Some of the cells grow and form, under the serous membrane which has not yet disappeared, the dorsal wall of the body, and the dorsal plate or dorsal organ. Through the growth of the parts forming the lateral walls of the body, the dorsal organ gradually becomes covered, its cells sink into the yolk and seem to break into fragments. After the ectodermal parts of the digestive canal (fore and hind intestine) have formed, amœboid cells still migrate into the yolk, and seem to contribute to its fluidity (verflussigung). After hatching, the whole yolk by a pumping movement, gradually becomes, including whatever is contained in the same, partly degenerate cells, thus pushing the so-called primary entoderm into the portion of the fore-intestine, called the crop. The mesenteron receives no epithelial covering from the primary entoderm, and the epithelium of the mid-intestine, namely, the definite or secondary entoderm, arises from the mesoderm, according to Korotneff, through the wandering blood-cells. The morphological significance of the strange dorsal organ is, according to Korotneff, nothing else than a stopper which fills up the dorsal gap of the body-walls of the embryo. Physiologically the organ plays an important rôle in the manufacture of the yolk-mass destined for the nourishment of the embryo. In the digestion of the yolk, so to speak, three kinds of cells are active: 1, the yolk cells; 2, the dorsal organ; 3, immigrant blood corpuscles. By the above considerations the want of a dorsal organ in eggs with a scanty yolk is explained.

The formation of the heart is very fully described. We will only give the following abstract. Blood cells are early present almost everywhere between the yolk and mesoderm; the heart becomes indicated in the form of two furrows, which draw near to one another together with the dorsal edges of the myoblasts, and which unite in the heart-tube; each furrow borders a wide blood-lacuna which covers the dorsal side of the yolk and becomes reduced to the cavity of the heart.

EXPLANATION OF PLATES XVIII AND XIX.

Lettering.

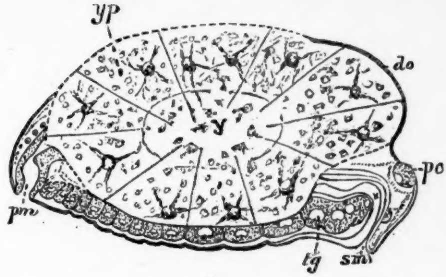
abc, amœboid blastodermic cells.
ant, antenna.
ar, arterial sinus.
bc, blastoderm cells.
bl, blastoderm.
bla, abdominal vesicles.
cr, proventriculus, or crop.
dm, ventral diaphragm.
do, dorsal organ.
dpm, dorsal diaphragm.
en, endodermal cells.
ent, enteric layer.
f, fat-body.
g, ventral ganglion.
H, *ht*, heart.
l, lacuna.
M′, cavity of the myoblast.
m, mouth.

mb, myoblast cells.
md, mandible.
men, mesenteron.
mx', 1st maxilla.
mx'', labium, or second maxilla.
ml, leaf-like portion of mesenteron.
N, nerve-furrow.
œ, œsophagus.
P, primitive groove.
pc, procerebrum.
pd, primitive disk.
pm, proctodæum.
sg, subœsophageal ganglion.
sm, stomodæum.
tg, thoracic ganglion.
vm, ventral muscle.
y, yolk.
yp, yolk-pyramids.
I, 1st pair of feet.
II, 2d " "
III, 3d " "

FIGURES.

FIG. 1.—Egg in which the amœboid (*abc*) nuclei are moving toward the surface.
" 2.— " " " " " have reached the surface, and show an active nucleus-formation.
" 3.—The blastodermic cells have no nucleus, and are placed at equal distance apart.
" 4.—The blastoderm cells now forming a continuous layer.
" 5.—Cross-section of the egg with blastodermic disk, also showing the disposition of the endodermal cells.
" 6.—Cross-section of the blastodermic disk, with the myoblast cells (*mb*) already formed.
" 7.—Cross-section through the thorax of the embryo; the body-cavity extended into the limbs.
" 8.—Longitudinal section of the embryo; the yolk-pyramids (*yp*) form a common inner yolk-mass (*y*).
" 9.—Section through the heart; *H*, cavity of the heart; the two halves of the heart-sinuses having united dorsally, ventrally they are still open and are bounded by the walls of the mesenteron.
" 10.—Cross-section of an embryo, showing the blood-lacunæ separated on the back by the dorsal organ (*do*); the intestinal fasciated layer (darmfaserblatt) has not completely enclosed the yolk.
" 11.—Embryo completely segmented, with the rudiments of the appendages, labrum (*lab*) and nervous ganglia (*pc–ng*).
" 12.—A more advanced embryo, showing the stomodæum (*st*) indicated as a frontal protuberance.
" 13.—Section through the recently hatched larva, showing the cells of the mesenteron or chyle-stomach, and the cellular layer on the front surface; also the proventriculus or crop.

DEVELOPMENT OF THE HONEY BEE.—An abstract of Grassi's observations appears in the Biol. Centralblatt, which we translate. The development of the honey bee is much more simple in some respects than that of the mole cricket because the necessary structures for the digestion of the food yolk are entirely lacking. Yolk cells exist after the formation of the one-layered blastoderm, but do not limit the cleavage of the yolk. The blastoderm is at first spread continuously over the whole egg, but afterwards becomes arrested upon the back. The mesoderm so arises from the ectoderm that a median ventral plate at the same time sinks in and becomes overgrown by the adjoining later parts. This plate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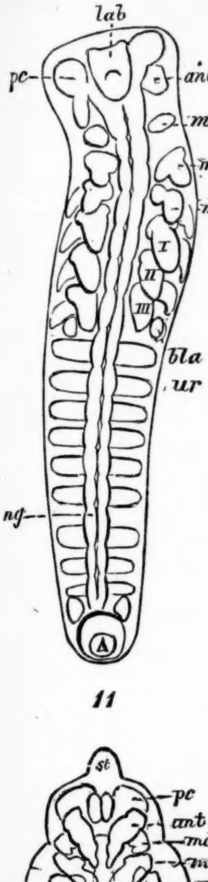
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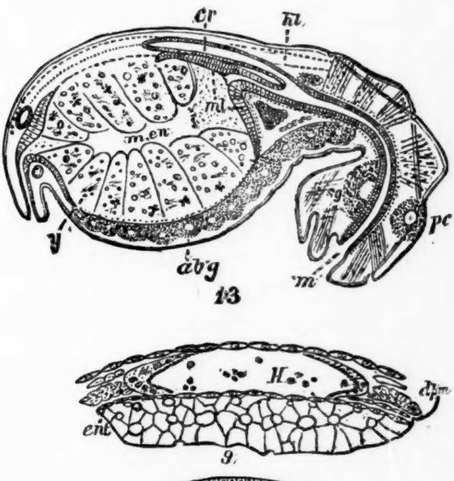
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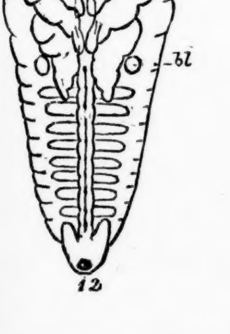
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is at first one-layered, and afterwards is composed of two layers, and then divides for the formation of the body-cavity. The posterior and anterior ends of the mesoderm-plate lengthen to form the mesoderm of the head and end of the abdomen. From these last portions of the mesoderm arises also the definite entoderm, viz., the epithelial covering of the mesenteron. The yolk cells thereupon disappear; according to Grassi the figures quoted from Tichomiroff as well as from O. and P. Hertwig, in regard to the proof of the origin of the endoderm in the yolk cells can also be explained to agree with his views. The amnion and serous membranes are not separated in the bee, but form a single layer of cells. Grassi is inclined to trace the embryonal membranes of insects phylogenetically from an especially modified dermal fold, which was inherited from the ancestors of the class; such a duplicature, suggests Emery, might be comparable to the mantle of many Entomostraca.

According to Grassi the cerebral ganglia arise independently of the ventral chain, and is afterwards connected with it. The entire nervous system and, as far as could be observed, also the commissures arise directly from the ectoderm. The antennæ are developed from the head plate (procephalic lobes) and are situated in front of the other appendages. A pair of cephalic appendages previously observed by Bütschli, which only appear for a short time in front of the mandibles, soon disappear. Grassi considers them as homologous to the second antennæ of Crustacea. He found abdominal appendages only exceptionally, and not on all the segments. The observations of Grassi on the mode of development of the heart agree well with those of Korotneff on Gryllotalpa; both uphold the hypothesis of Bütschli of the origin of the vascular system from the residue of the segmentation-cavity, *i. e.*, the primitive body-cavity. The sexual organs originate as two mesodermal elongated streaks in the 4th–8th abdominal segments.

The tracheæ arise very early; there are ten pairs of stigma present, the 1st thoracic and the two last abdominal segments wanting the same. In the corresponding place of the two last segments appear the germs of the malpighian tubes, which as soon as the hind-intestine is formed extend and open into it. Tracheæ and urinary tubes should be regarded, as P. Mayer supposed, as homodynamic organs. This opinion is also supported by the results of Tichomeroff's researches on the silk-worm; the latter found nine pairs of stigmata, but three pairs of malpighian tubes. Grassi further supposes that the silk glands and other invaginations or "head-canals" found by him near the mandibles and maxillæ are homologous with the tracheæ.

In case an entodermal origin for the antennal glands of the Crustacea and the segmental organs (schleifenkanali) of annelids becomes proved, then the first might be the homologues of the

head-canals of the bee-embryo, and both the tracheæ and malpighian tubes be proved homologous with the nephridia of the annelids.

From such a view Emery dissents: he thinks the relation of these organs in Peripatus are not consistent, since in that animal occur both nephridia and trachea, unless we suppose that the tracheæ of Peripatus and of the other arthropods are not equivalent. If one accepts the fact that the tracheæ and the malpighian tubes have originated from diffusely distributed cutaneous glands, then one could further suppose that their openings unite later with the openings of the nephridia, by which means they assumed a segmental arrangement. But, however, it is not at all necessary to make the nephridia arise from the ectoderm, which would contradict all the researches hitherto made.

Lintner's Second Report as State Entomologist of New York.—This forms a volume of 265 pages, representing work done in the years 1882 and 1883. Besides many miscellaneous notes on various local attacks of insects and remedies, certain well-known injurious caterpillars are described at length, as well as noxious flies, beetles, bugs and orthopterous and neuropterous insects.

In the appendix, reprinted from other sources, is described a new sexual character in the pupa of some moths, and an egg parasite of the currant saw-fly is described, while besides is a list of notes of a miscellaneous nature published in various journals, succeeded by a reprint of Fitch's Winter Insects of New York.

The report is rather more miscellaneous and contains perhaps the results of less field work than the first, but still will prove serviceable to the farmers of New York.

The State should be more liberal in affording illustrations for so important and useful a report, those not reproduced being poorly drawn and engraved. This is not the fault of the entomologist, and should not be under the control of the State printers.

Entomological News.—At the meeting of the French Academy for Jan. 25, M. J. Chatin read a note on the comparative morphology of the labium in Hymenoptera.——In the Bulletin of the Buffalo Society of Natural Sciences (Vol. v, 1), Dr. D. S. Kellicott describes as new *Nonagria subcarnea*, and compares its larva with that of *Sphida obliquata*.——In the *Canadian Entomologist* for January Mr. Herbert Osborn publishes a useful preliminary list of the species of mites of North America.——In *Entomologica Americana* for March, D. W. Coquillet gives a synopsis, with descriptions of new species, of our species of bombylid flies of the genus Toxophora. Miss M. Murtfeldt shows that certain seed-feeding Coleophora larva, which remain ten or eleven months, and sometimes even longer, in a dormant state,

not feeding in the spring or summer months.——Mr. H. B. Möschler discusses the systematic position of the genus of zygænid moths, Triprocris.——At the meeting of the Washington Entomological Society for Feb. 11, Mr. Schwarz said that among the many forms of secondary sexual characters in the Coleoptera, some would likely be found to be analogous in function to those in the Lepidoptera. He referred more particularly to the tufts of hair in the mentum of Trogosita, and those on the ventral segments of the male of Dermestes. Differences in the vestiture of the sexes are known to occur, *e. g.*, Hoplia, where the male has scales and the females only hairs; but in this case it is hardly possible that we have to do with odoriferous organs.

ZOOLOGY.

Markings of Animals.—Eimer has advanced the view that the markings on animals are primitively longitudinal stripes, which may subsequently be broken up to form dots, and these fuse to form transverse rings. This view is supported by the ontogeny of many animals. Dr. W. Haacke controverts this view from the study of an Australian fish, *Helotes scotus.* The adult fish is marked by eight longitudinal black bands; young specimens have in addition a row of clear transverse bands, which disappear when the fish attains to maturity.—*Journ. Roy. Micr. Soc., February, 1886.*

Blind Crabs.—Mr. J. Wood-Mason states that four species of Brachyura were dredged in the Bay of Bengal from depths exceeding 100 fathoms, during the past season, by H. M.'s Indian marine survey steamer *Investigator.* They belong to the genera Amathia, Ethusa, Eucephaloides (n. gen. allied to Collodes Stimpson) and Lyreidus, of which the last named (*L. channeri*) is especially interesting on account of the rudimentary condition of the eyes.

These organs are unequally reduced, the cornea of the left being of the normal form and extent, but opaque and devoid of all traces of facets, as in Munidopsis, Orophorhynchus, Nephropsis and other blind forms of the deep sea, while that of the right is entirely aborted, its place being only indicated by a small smooth spot marked out by the transparence of a lead-colored pigment similar to that which is seen through the integument around the base of the left eye. This interesting brachyuran, which is at once distinguished from the Japanese and American species by having the anterolateral margin of the carapace armed with two pairs of long and slender spines, were trawled up from a depth of 285–405 fathoms.—*Jour. Roy. Micr. Soc., February, 1886.*

The Intercentrum in Sphenodon (Hatteria). — Professor Cope, in his important note on this point (Am. Nat., Feb., '86)

has shown that the intercentrum in Sphenodon is complete in the caudals; I can add that the same condition is to be found in the præcaudal vertebræ also. This makes Professor Cope's view of the Embolomeri being the batrachian type ancestral to the Reptilia, still stronger.

Fritsch[1] believes that he has found the representatives of the pleurocentra in the cervicals of a young Sphenodon; the præzygapophyses, he says, represent these elements; which are developed from a distinct point of ossification (according to Fritsch). I examined two Sphenodons in alcohol (one about 290^{mm} long). I could not find such a condition, and nobody will find it, not even in embryos. Archegosaurus has well developed præzygapophyses, *besides* the pleurocentra. In *no* vertebrate are the præzygapophyses developed from a distinct center; and Sphenodon makes no exception. The "centrum" of the vertebra in reptiles and mammals is formed by the pleurocentra; and embryology of the Reptilia will probably show that the centrum is developed from two lateral elements.—*Dr. G. Baur, March 23, 1886.*

Zoological News.—*Mammalia.*—H. H. Johnson, in his work on the Kilimanjaro expedition, notes a singular resemblance (which some may call mimicry) between the aspect of the tall red-brown antelope, *Alcelaphus cokei*, and the mounds built by termites. The color being the same and the long grass hiding the animal's legs, it was really difficult to distinguish an antelope from an ant hill. The mimicry was sometimes made more ludicrously exact by the sharply pointed leaves of a kind of squill, which suggested the horns of an antelope.——F. W. True has described in a recent issue of the Proc. U. S. Nat. Mus. a new species of Mesoplodon (*M. stejnegeri*) obtained on Bering island by M. Stejneger. The species rests upon the characters of the cranium, quite badly water-worn, of a young individual. In general proportions it agrees with the skull of *M. hectori*, but the contour of the occipital, the section of the beak, etc., are different.——Mr. True pronounces the *Hyperoodon semijunctus* of Cope to be a Ziphius, distinct from *Z. cavirostris*. In the general form and proportion the skull approaches most closely to *Z. gervaisii.* ——Sowerby's whale (*Mesoplodon bidens*) has been found upon the coast of Yorkshire. A male specimen fifteen feet nine inches long was left stranded in shallow water at the entrance to the Humber. Fourteen instances of the occurrence of this species on various parts of the European coast and one in North America (Nantucket, 1867) are enumerated (*Ann. and Mag. Nat. Hist.*, Jan., 1886).

Reptiles, etc.— Mr. A. B. Macallum (Quart. Journ. Mic. Soc., Nov., 1886), gives the following summary of the results of his

[1] Fritsch, A. Fauna der Gaskohle. Bd. II, Heft II, Prag, 1885.

studies of the nerve terminations in the cutaneous epithelium of the tadpole. Certain fibers, placed below the corium and known as the fundamental plexus, give origin to fibrils which enter the epithelium and end in comparatively large bead-like bodies between the cells, and may or may not branch, arise from a network of fine anastomozing nerve-fibrils situated immediately below the epithelium and forming meshes smaller than the space covered by an epithelial cell. One, commonly two, often three or more, nerve-fibrils terminate in the interior of each epithelial cell near its nucleus. The figures of Eberth are sheaths for intra-cellular nerve-terminations. —— Colonel R. H. Beddome describes the earth snakes (Uropeltidæ) of India and Ceylon in a recent number of the *Annals and Mag. of Nat. Hist.* Six species of Rhinophis, one of Uropeltis, nineteen of Silybura, five of Plectrurus, one of Teretrurus (nov. gen.), three of Melanophidium, and three of Platyplectrurus are characterized. Several species are new.

Fishes.—Nature (Feb. 4, 1886) has an interesting article by A. Ernst upon the shoals of living and dead fishes which are cast upon the shore of Carupano, Venezuela. The place is celebrated for the occurrence of these shoals, which for the most part consist of small fishes, and are composed of several distinct species. The shoals are most common from May to November, during the rainy season, but in fine weather, when there is a moderate breeze from the sea. Sharks and other predatory fishes, as well as whales and sea-gulls, follow the shoal. The movement of the fishes is probably due to migration in search of food, the conformation of the coast at Carupano is such as to favor the embayment of the shoals at that point, and the death of the fishes is caused by submarine eruptions of gases. —— T. J. Cunningham (Quart. Jour. Micr. Soc.) contributes observations upon the relations of the yolk to the gastrula in teleosteans and other vertebrate types. At an average temperature of 7.5 C. whiting began to hatch on the tenth day, haddock on the eleventh. The fertilized ova of the cod, haddock and whiting are similar in all respects save size, while the ovum of *Trigla gurnardus* has a single large, brownish-yellow oil-globule. In the earlier condition of the periblast the cells of the blastoderm are continuous with it. The invaginated layer of the germinal ring is never continuous beneath the segmentation cavity, nor is it continuous with the periblast; it passes beneath the axis of the embryo, and from the first constitutes the dorsal hypoblast. The floor of the intestine is in all probability derived from the periblast. The whole edge of the blastoderm represents the ancestral blastopore, and the formation of the embryo by concrescence is simply the closing of the blastopore from before backwards. The edge of the blastoderm in Amphibia, Petromyzon and the ganoids is homologous with that of teleosteans but not with that of elasmobranchs. The inflected part of this edge in the latter represents the whole of it in

the teleosteans. The ancestral part of the primitive streak in Sauropsida represents the ancestral blastopore, while the posterior part represents the coalesced uninflected part of the blastodermic rim in the elasmobranchs.——The fish fauna of Lake Balkhash, according to M. Nikolsky, numbers fourteen species, viz., *Perca schrenkii*, Phoxinus (two sp.), *Barbus platyrostris*, Schizothorax (five sp.), *Diptychus dibowskii* and three species of Diplophysa. All but one of these are new, and none are found either in the Aralo-Caspian basin or in the system of the Obi. Five genera are common to Lake Balkhash and the Central Asian lakes. In all these lakes Cyprinidæ and Cobitidæ predominate, and two species are common to Lob-nor and Lake Balkhash. Three species, the two Phoxini and the perch, are the only ones which ally the fauna of the latter lake to that of the Obi. From these facts M. Nikolsky concludes that if the depressions of the Alatau, Aral-Caspian and Siberia were ever a continuous marine basin, the first was separated earlier than the others.——Messrs. G. B. Goode and T. H. Bean describe sixteen new species of fishes (Proc. U. S. Nat. Mus., Oct., 1885) obtained by the U. S. Fish Commission mainly from deep water off the Atlantic and Gulf coasts. The species include five Heterosomata (Aphoristia two, Hemirhombus one, Citharichthys one, Etropus one), two species of Macrurus, one of Coryphænoides, one of Malococephalus, three of Bathgadus, one of Neobythites (nov. gen.), one of Porogadus (n. g.) and two of Bathyonus, which last name is a substitute for Bathynectes Gnthr., preoccupied in Crustacea.

Mollusks.—It appears from the experience of Mr. W. Armstrong and W. K. Brooks that seed oysters grow more rapidly and are of a better shape when placed on floating collectors than when deposited on the bottom. This is due to the absence upon these floating surfaces of the sediment which often forms a coat upon the bottom before the spat can become attached.——Those who wish to know how a list of species fares in the hands of one who critically republishes it, should look over the Report on the testaceous Mollusca obtained during a dredging excursion in the Gulf of Suez in the months of February and March, 1869, by Robert MacAndrew. Republished, with additions and corrections, by Alfred Hands Cooke (*Ann. and Mag. Nat. Hist.*, Feb. 1886).

Echinoderms.—M. G. Cotteau has put forth a preliminary but important paper upon the Eocene Echini of France, containing descriptions and figures of the species belonging to the genera Spatangus, Maretia, Euspatangus and Hypsospatangus.——Howard Ayers, as a result of studies of the structure and function of the Sphæridia of the Echinoidea, carried on at Banyul-sur-Mer (Quart. Jour. Micr. Soc., Nov., 1885), arrives at the conclusion that these organs possess the double function of taste and smell.

They are much more highly specialized than they are described by Loven to be, and have in fact a greater specialization of parts than can be seen in similar organs in the Medusæ. Sounds, which affect the spines and pedicellariæ immediately, are not noted by the sphæridia, which are first to recognize the presence of a drop of acetic acid in the water.——Mr. R. Rathbun (Proc. U. S. Nat. Mus.) contributes a report upon the Echini collected by the U. S. steamer *Albatross* in the Gulf of Mexico from January to March, 1885. Thirty-one species were collected in suitable condition for determination. These represent seventy-eight dredging stations in from twenty-one to 1330 fathoms, only one species having been obtained in shore collecting. Seventeen species were additional to those obtained in 1884, yet nine species of that date were not found in 1885.

Worms.—Dr. von Linstow (Zeit. f. wissen. Zool.) enumerates fourteen courses of development known among Nematelminths, according to the medium in which they develop. (1) Some genera pass directly into an adult form; (2) the larvæ live in the earth, the adults in plants; (3) the larvæ live in worms, and on their death pass into the earth and become adult; (4) in *Sphærularia bombi* the adults live in the earth, and the fruitful females enter the bodies of bees and there reproduce; (5) the larvæ live in the earth, the adults in some animal; (6) the hermaphrodite worm lives in some animal, while the offspring develops into bisexual forms in the earth; (7) some adults are free-living and sexual, others hermaphrodite and parasitical on animals; (8) the larvæ hatch in the earth and develop into hermaphrodite forms in animals; (9) the larvæ live in insects, the adults in earth or water; (10) the larvæ live encapsuled in one animal, and with it pass into the digestive system of another animal and become adult; (11) the hermaphrodite form lives a short time in the intestine of some animal and here produces a larva which becomes encapsuled in the muscles; (12) the adults live in the tracheæ of birds, the embryos are expectorated, swallowed with the bird's food, hatch out in the crop and œsophagus, wander into the bronchiæ and air-sacs, and thence to the tracheæ (*Syngamus trachealis*); (13) Gordius has two larval forms, one in beetles the other in mollusks, while the adults live in water; (14) of two larval forms one is aquatic, while the other inhabits the lung of an amphibian and passes thence into the intestine of the same animal where it develops into the hermaphrodite form. This is the case with *Nematoxis longicauda*, the last form of which is described and figured by Dr. Linstow.——The annelid, *Siphonostoma diplochætus*, according to M. Et. Jourdain, has two pairs of true eyes provided with a refringent body analogous to that present in tunicates, and traversed with radiating striæ. This worm is common in the mud near Marseilles, and is covered with a very thick coat of mucus derived from two types of papillæ,

the one ovoid, as it were, isolated in the mucus and formed of glandular cells similar to those which enter into the structure of the epidermis, the other fusiform and with filaments at their extremity. The papillæ are joined to the body by long and slender peduncles.—— F. E. Beddard (*Ann. and Mag. Nat. Hist.*, Feb., 1886) describes three species of Perichæta and one of Moniligaster from Ceylon and the Philippines. The latter genus is remarkable for the apparent absence of a clitellum and the presence of five distinct gizzards in the œsophagus.

Protozoa.—A. C. Stokes (*Ann. and Mag. Nat. Hist.*) describes several New Infusoria from American fresh waters.——H. J. Carter describes in the January and February numbers of the *Ann. and Mag. of Nat. Hist.*, thirty-five species of sponges from the neighborhood of Port Phillip heads, South Australia.

EMBRYOLOGY.[1]

ON THE SYMMETRY OF THE FIRST SEGMENTATION FURROWS OF THE BLASTODISK OF ELASMOBRANCHII.—The nearly symmetrical subdivision of the blastodisk of Teleosts by the first four segmentation furrows has long been known. The details of the early development of the blastodisk of Teleosts have been very carefully elaborated by Agassiz and Whitman,[2] whose conclusions are, I believe, generally accepted by embryologists. Of the development of the blastodisk of Elasmobranchs we know comparatively little, especially in relation to the relative position and direction of the first segmentation furrows. The object of the present note will therefore be to describe the early segmentation of the blastodisk of one of the latter, viz., *Raia erinacea,* as displayed by an egg removed from the oviduct and cloaca of a female of that species, July 11, 1885, at Wood's Holl, Mass.

Upon opening the tough horny membranous envelope in which the ovum proper of Raia is enclosed, it is found that the egg is somewhat pinkish in color, and is imbedded in a layer of very glairy " white " or albumen, which fills up the space between the egg and the horny case. The pinkish egg proper is somewhat flattened and oval in shape, and is immediately invested by a very thin and delicate vitelline membrane. At one side of the flattened vitellus, which measures nearly one and a quarter inches through its longest diameter, a small circular whitish area about two millimeters in diameter is noticeable. This is the blastodisk or germinal area of authors, and is the point where development first begins to manifest itself.

If the egg case is carefully opened, the white removed and then laid into a one per cent solution of chromic acid, the blasto-

[1] Edited by JOHN A. RYDER, Smithsonian Institution, Washington, D. C.

[2] On the development of some pelagic fish-eggs. Proc. Am. Acad. Arts and Sci., xx, 1884.

disk may be hardened *in situ* without distortion, and afterwards separated from and carefully lifted off of the underlying vitellus, together with a thin hardened flake of the latter to support it. Such was the treatment to which the blastodisk here figured and described was subjected. The surface view, Fig. 1, was drawn with the camera lucida after hardening, and the section shown in Fig. 2 was drawn from one taken at about the position of the line *a* in Fig. 1. Cleavage had already advanced so far as to subdivide the area of the blastodisk into fifteen sharply defined cells, so that it may be assumed that this blastodisk has nearly completed its sixteen-celled stage of development or that the fourth cleavage is about completed.

A comparison of the first four cleavage planes of this blastodisk shows that they are formed in very nearly the same order and relation to each other in Elasmobranchs as in Teleosts. For example, the first plane I, in Fig. 1, has cut through the originally circular blastodisk and caused it to become elongated at right angles to the direction of the first segmentation furrow exactly as in the eggs of teleostean fishes. The second furrow, II, cuts the first at right angles so as to further subdivide the first two cells into four. The next cleavage is caused by two nearly parallel furrows, III, III, which appear simultaneously, and further subdivide the cells of the blastodisk into eight. The fourth cleavage is caused by two parallel furrows, IV, cutting the blastodisk approximately at right angles to the two furrows of the third cleavage. It thus results that sixteen cells will be developed, and it will be apparent also that the method of segmentation thus indicated is exactly comparable with that characteristic of the developing ova of teleosteans. We have, in fact, the same elongation of the blastodisk in one direction as is produced by the first segmentation furrow in the latter. The same oblong, squarish outline of the blastodisk as observed in the sixteen-celled stage of teleostean development is also obvious, and it is also evident that such a squarish configuration of the blastodisk does not disappear until the morula condition is reached or at least approximated, just as in Teleosts. These data serve to show that the features of segmentation as observed by several investigators in the eggs of Teleosts are repeated with no essential variation in the de-

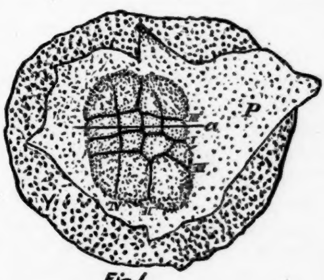

Fig. 1

Fig. 2

velopment of the eggs of the Elasmobranchs. The subdivision of the blastodisk into cells in both types of Ichthyes is essentially a symmetrical one, determined by the first cleavage plane. Whether or not the first cleavage plane of the ovum of elasmobranchs coincides with the median plane of the future embryo, as supposed by Whitman, Roux, Pflüger and E. Van Beneden, it is impossible to decide at present, but it would seem not at all improbable that such might be the case.

A series of sections of this blastodisk of Raia, prepared by the aid of a Cambridge rocking microtome, which was presented to the U. S. Fish Commission by Professor Adam Sedgwick, have enabled me to reach some interesting conclusions in reference to the structure of the blastoderm of the Elasmobranchii during its one-layered condition. At this stage the four median or central cells are not completely sundered from the underlying periblast, P, Fig. 2, since the cleavage furrows are found to terminate abruptly before they have quite cut through the finely granular plasma of the blastodisk proper, as shown in Fig. 2. In this respect the cleavage of the blastodisk of Elasmobranchs differs very decidedly from that of teleosts as described by Agassiz and Whitman in the paper already cited.

The germinal plasma of the disk is composed of a clear substance in which very fine granules are imbedded. These granules are probably of the same nature as the crystalloids or tabular crystal-like rigid bodies which largely enter into the composition of the yolk Y. In fact a careful examination reveals the fact that the very finely granular plasma of the segmenting blastodisk passes by insensible gradations into that of the yolk charged with very coarse granules or tablets. An exceedingly thin envelope of finely granular plasma, which is continuous with the margin of the blastodisk, covers the entire vitelline mass. This is represented by the irregular outline of the area P in Fig. 1, below which lies a discoidal mass of coarsely granular yolk, Y. In Fig. 2 the relations of the cortical layer P, or periblast, to the vitellus are still more distinctly shown, and it is very evident that the plasma of the blastodisk is continuous inferiorly with the vitelline mass, and that a cleavage cavity must be developed at a considerably later stage.

The lower limits of the segmentation furrows were very sharply defined, as shown in Fig. 2, and the nuclei of the constituent cells of the blastodisk were observed as clear round or oval areas in the plasma of the cells, and near the center of each one could be seen a very well marked nearly globular chromatin body, which occasionally was observed to be provided with irregular processes which extended outward into the nuclear space. No karyokinetic phenomena were observed.

From what has preceded it does not seem at all probable that the "free nuclei" which are finally developed under the blasto-

disk of Elasmobranchs originate spontaneously. It is indeed far more likely that they originate by a process of segmentation in which the marginal cells of the blastodisk are involved the same as in Teleosts. Such a view is in fact supported by fig. 15 given in Balfour's Comparative Embryology, Vol. II, p. 34, in which two free nuclear spindles are shown at the edge of the deeper-lying part of the blastodisk of Pristiurus in the morula condition, consisting of four superimposed rows of cells. Balfour's figure also shows that between the lowermost cells composing the blastodisk and the coarsely granular vitellus there is still a considerable unsegmented stratum of finely granular plasma interposed. In this lower layer of finely granular plasma alone the "free nuclei" are found, thus furnishing additional evidence that the view expressed above as to the origin of such nuclei is probably correct. In the disk of Raia examined by me the cleavage planes are also marked by the clear margins of adjacent cells, as in the blastodisk of Pristiurus figured by Balfour. The blastodisk of Raia here figured and described measured 1.71 millimeters in width and 2.37 millimeters in length. Its thickness in the center was about .6 of a millimeter, and thinned out at the margin into a very thin layer of plasma which is obviously homologous with the cortical or periblastic layer of the teleostean egg. Later stages of the blastodisk of Raia show it subdivided into smaller and more irregular cellular areas; the whole disk also again assumes much more nearly the original discoidal form characteristic of it previous to the beginning of segmentation. To judge from the condition of the blastodisk here described, it of course is to be inferred that the fertilization of the egg takes place while it is still in the oviduct, or possibly even before it enters the latter.—*John A. Ryder.*

PHYSIOLOGY.[1]

Glycogenic Function of the Liver.—I see that in your general notes on Physiology in the April number of the American Naturalist, p. 397, an abstract is given of Professor Seegen's researches on the glycogenic function of the liver. One of his most important conclusions is that peptones are destroyed in the liver by being split into liver-sugar and a nitrogenous residue. Now this is exactly the conclusion at which I arrived in my paper, "On the glycogenic function of the liver," published eight years ago.[2] In that paper I say (p. 102): "Therefore—and this is a very important point—*albuminoids are decomposed in the liver into glycogen and some nitrogenous matter* which is excreted partly in the bile but probably mostly restored to the blood to be excreted as urea by the kidney. In this way excess of albuminoid over and above what is necessary for build-

[1] This department is edited by Professor Henry Sewall, of Ann Arbor, Michigan.
[2] *Am. Jour. Sci.*, Vol. XV, p. 99, 1878.

ing is reduced to a condition suitable for combustion." I do not pretend to put my results, founded entirely on general reasoning, on the same footing as the careful researches and experiments of Professor Seegen, but it seems to me so explicit a statement deserves recognition.

Again Professor Seegen draws attention to the fact that fasting animals still continue to make liver-sugar and that therefore this function *is continuous*. In the same paper I state that waste tissues being albuminoid are undoubtedly eliminated in the same way, *i. e.*, by splitting in the liver into a carbo-hydrate *which is burned* and an incombustible nitrogenous residue to be eliminated mostly by the kidneys. The researches of Schiff[1] demonstrate that waste tissue undergo some important, yea necessary, change in the liver, but as to the nature of the change he says nothing. If the disposal of waste is connected with sugar making, as I affirm, this fact entirely explains the continuity of the function.

Again Professor Seegen says: "The formation of peptones (at least in carnivores not growing) is mostly to form sugar." I say, "The whole albuminoid-excess is split into sugar to be burned for vital force and vital heat and an incombustible residue to be otherwise eliminated, *i. e.*, the whole albuminoid-excess is utilized as sugar."

As to the experiments of Professor Seegen and others showing that with carbo-hydrate diet the sugar in the portal vein is less than in hepatic vein, I confess they are wholly unintelligible to me. What becomes of the sugar which is absorbed in such large quantities? Is it not possible that it may be present in some form which does not respond to the ordinary tests for glucose?

The final conclusion of Professor Seegen that *glycogen* always present in the liver *is not the source of liver-sugar*, must be established on very firm basis before it will be accepted by physiologists.—*Joseph LeConte.*

BERKELEY, CAL., *April 8, 1886.*

PSYCHOLOGY.

MEYNERT'S PSYCHIATRY,[2] VOL. I.—This volume of 285 pages is largely devoted to the gross and minute anatomy of the brain. Besides the appendix on the mechanism of expression, and a short chapter on the nutrition of the brain, two-thirds of the book are devoted to anatomy and one-third to the physiology of this important organ. The work represents the results of Meynert's researches up to 1884, and is of first-class value as embracing the

[1] Arch. des Sciences, Vol. 58, p. 203, 1877.

[2] Psychiatry, a clinical treatise on diseases of the Fore-brain. By Theodor Meynert, M.D., professor of nervous diseases and chief of psychiatric clinic of Vienna. Translated by B. Sachs, M.D. Vol. I. New York, G. P. Putnam's Sons. 8vo, 1885.

descriptions of a master in cerebral anatomy and physiology. The text is accompanied by mostly excellent engravings, which are so necessary to the comprehension of this abstruse subject. We give some of these, Figs. 1, 2 and 3 (Nos. 9, 24 and 56 of the book) which represent structure, and Fig. 4 (60) which illustrates the law of muscular action under stimulus.

Meynert opens his chapter on the physiology of the brain with the assertion (p. 138) that it is an organ of which the function may be inferred from its structure. This inference is justified by facts of physiology both normal and abnormal. The most important normal physiological law which is adduced in evidence,

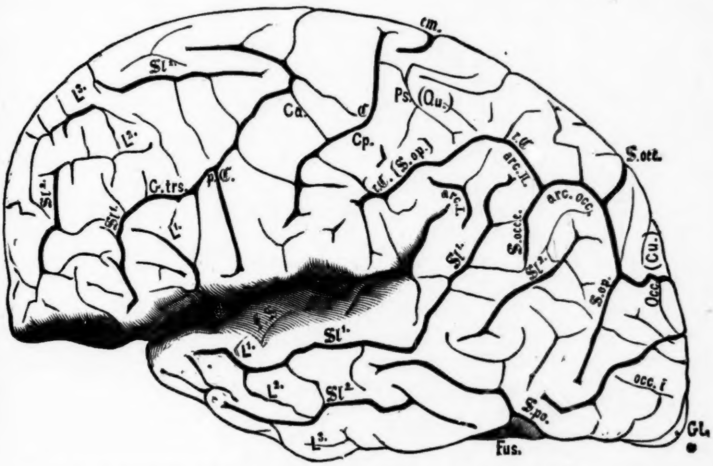

FIG. 1.—Convexity of the human brain. *J*, island of Reil; 𝔉𝔖, sylvian fissure. The letters are placed on the temporal lip of the fissure; above the island lies the operculum, bounded by the anterior ascending limb, which passes upward toward the letters 𝔖𝔩′, and the posterior ascending limb approaching the lettering *arc. I*. ℭ, central fissure; 𝔭ℭ, præcentral fissure (anterior radial fissure); 𝔯ℭ, (𝔖.𝔬𝔭), post-radial fissure (sulcus occipito-parietalis); 𝔖.𝔬𝔠𝔠, occipital fissure; 𝔖𝔩¹, 𝔖𝔩³, longitudinal fissures in frontal and temporal lobes; 𝔖𝔩¹, designates below parallel fissure; 𝔖.𝔭𝔬, præoccipital fissure (fus gyrus fusiformis); *Ca*, anterior central convolutions; *Cp*, posterior central convolutions; *Ps* (*Qu*), superior parietal lobe (lobus quadratus); *arc I*, *arc II*, inferior and superior parietal convolutions; 𝔖.𝔬𝔠𝔠.𝔢, external occipital fissure (ape fissure); *Cu*, *Occ*, *Occ i*, the three occipital convolutions of Ecker; *Cu*, indicating the convex surface of the cuneus, and *Occ i* designating the convex surface of the gyrus lingualis; *Gl*, *em*, callosomarginal convolution; *arc.occ*, occipital arch; L^1 L^2 L^3, above 𝔉𝔖, frontal convolutions.

is that of Bell, "that the conduction of nerve force is in a centripetal direction through the posterior, and in a centrifugal direction through the anterior spinal roots." That cerebral function has definite locations is demonstrated by three facts among many others. The first of these is the intimate relation observed to

exist between the size of the olfactory lobe and the sense of

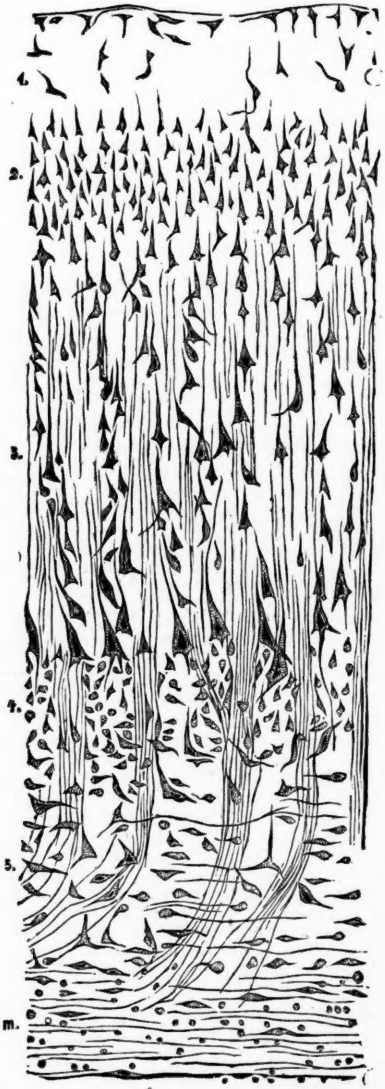

FIG. 2.—Section through the third longitudinal convolution of the frontal lobe adjoining a fissure. The fine layer type of the cerebral cortex. 1, superficial layer of neuroglia; 2, layer of small pyramids; 3, layer of large pyramids ("formation of the cornu ammonis"); 4, the granular layer; 5, the layer of spindle-shaped cells ("claustral formation"); *m*, medullary substance of the convolution.

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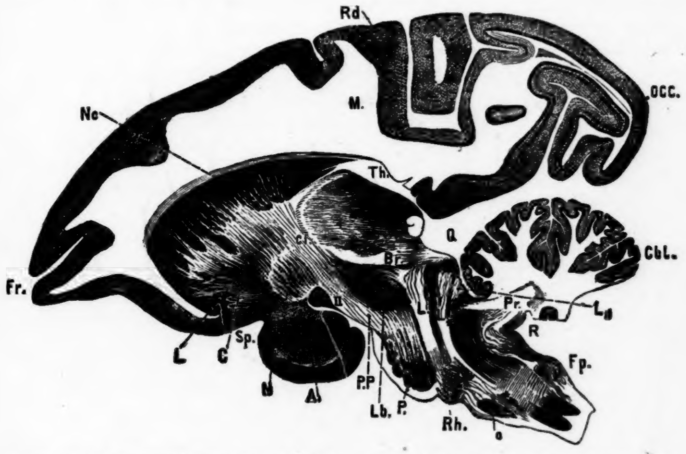

FIG. 3.—Transparent longitudinal section through the brain of a monkey. *Fr*, frontal end; *occ*, occipital end; *Rd*, cortex cerebri; *M*, medullary substance of the fore-brain; *Nc*, caudate nucleus; *L*, lenticular nucleus; *C*, anterior commissura; *N*, globus pallidus; *A*, amygdala; *II*, optic tract; *C.I*, internal capsule; *Th*, thalamus; *Br*, brachium corporis quadrigemini; *Lb*, discus lentiformis (by mistake of the engraver united to the stratum intermedium. The dark-pointed triangular mass in front of it is the radiation of the posterior longitudinal fasciculus. Underneath *Br* the radiation of the nucleus ruber); L L_I L_{II}, lemniscus of the superior and inferior corpus bigeminum, and of the valvula cerebelli; *P.P*, pes pedunculi; *P*. pons varioli; *Rh*, corpus rhomboideum; *O*, inferior olive; *Cbl*, cerebellum; *Pr*, processus cerebelli ad cerebrum; *R*, corpus restiforme; *Fp*, funiculus posterior.

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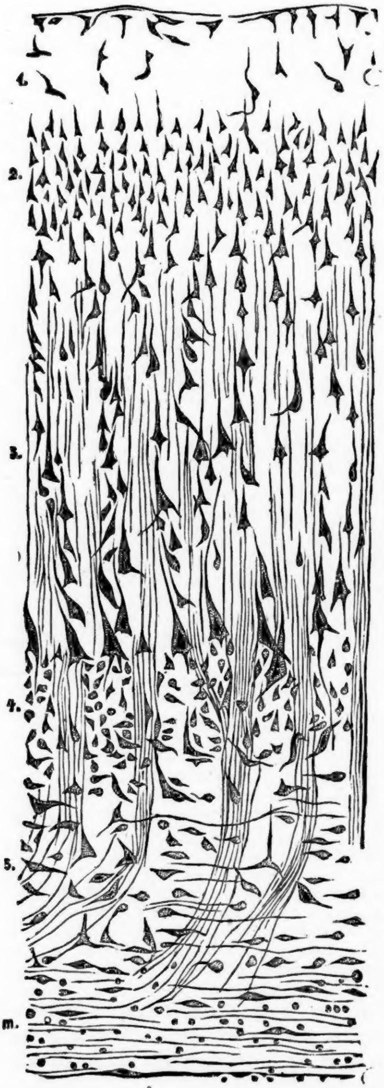

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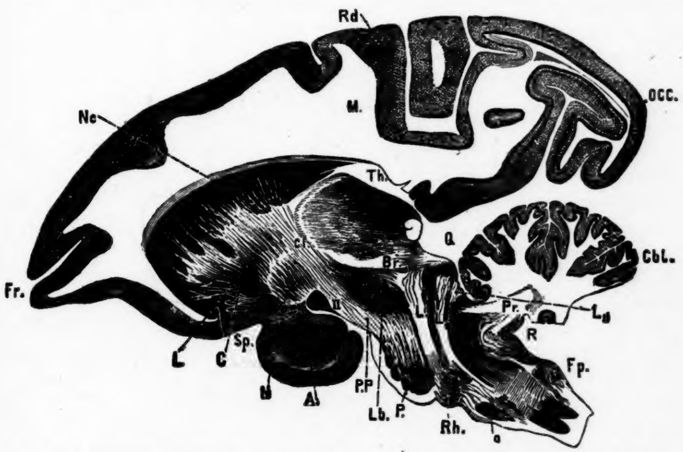

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equal activity of the fore-brain, constituting individuality, varies as regards contents and degree with each person; it is designated

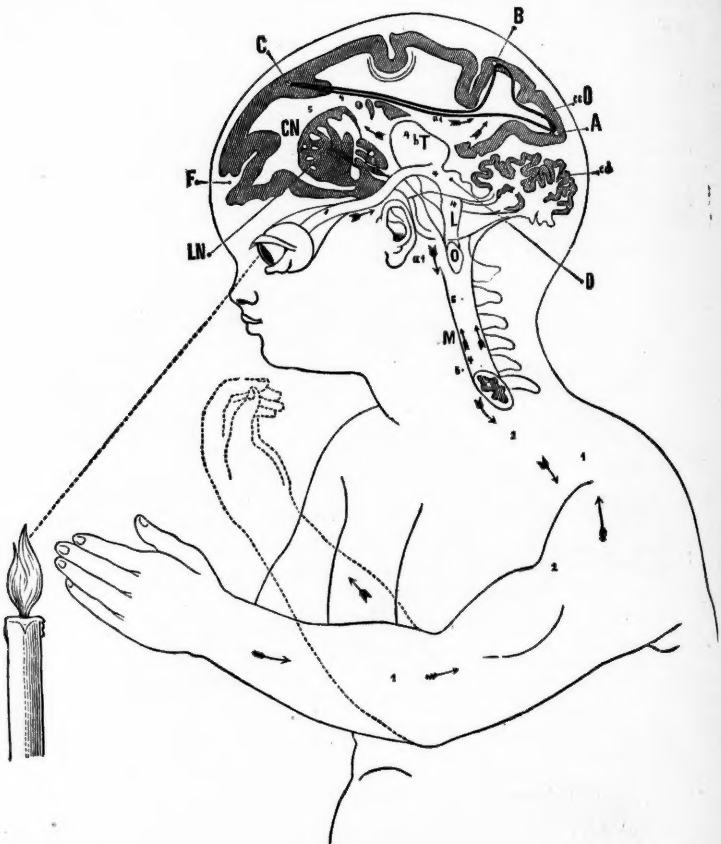


FIG. 4.—Diagram explaining the mechanism of a conscious movement of the arm. *F*, frontal cortex; *ccO*, occipital cortex; *C.N*, nucl. caud.; *L.N*, nucl. lenticularis; *hT*, thalamus opticus; *D*, mesen cephalon; *L*, pons variolii; *O*, med. oblongata, characterized by the olivary body; *M*, medulla spinalis, terminating with a cross-section of the cervical spinal cord; *cd*, cerebellum, blue lines indicate centripetal. red lines centrifugal tracts, the red and blue circles in the spinal cord and fore-brain denote central gray nuclei, black lines mark the association fibers; *IaI*, sensory tract of the arm; *B*, part of the cortical center for cutaneous sensation; *2*, tract for effecting the movement of the arm; *3A*, conducting tract of the optic nerve: *A*, part of the visual center; *4C*, tract conducting sensation of innervation interrupted in the thalamus; *C*, a center in the cortex for sensations of innervation; *5*, centrifugally conducting tract originating in the cortical area *C*.

also as the character of each individual. It has been justly observed that if the character (individuality) of a person were entirely known, we would be able to predict the thoughts and deeds of such an individual, however complicated they might be."

On p. 170 it is pertinently remarked, that "there is no gap between conscious and reflex movements to be filled in by instinct."

Dr. Meynert makes the following reference to the nature and value of our cognitions (p. 183): "I wish to add that it is the boldest hypothesis, shared alike by the ordinary mind and by scientific realism, to assume that the world is such as it appears to the brain to be; that the latter can be likened to a mirror which simply reflects the forms of the outer world; that the world as it appears to the brain exists independently of the presence or absence of mind. Indeed, it seems to me to be a crucial test of an individual's power of thought to determine whether he can conceive or not of the unreality of the world clad in forms which our minds have bestowed upon it. It should be reiterated that the idealistic conception of the world is supported by physiological facts, and still more positively by the facts of cerebral architecture before alluded to." We cannot learn from this paragraph whether Dr. Meynert is an idealist in the Berkeleyan sense or not. In any case the pathological argument has a double edge. Perceptional and ideational incapacity, based on pathological conditions, no more prove the unreality (*i. e.*, immensurability) of the *non ego*, than the perfection of our cognitions enables us to perceive all there is of the world. Because we do not apprehend all, it is not to be inferred that we therefore apprehend nothing.

Dr. Meynert promises to discuss the important question of hereditary predisposition to mental disease in the second part of the work. He outlines his position on this question in the preface to Vol. I in the following language: "It is taking altogether too simple a view of things to regard morality as one of man's talents and as a definite psychical property which is present in some persons and lacking in others."—*C.*

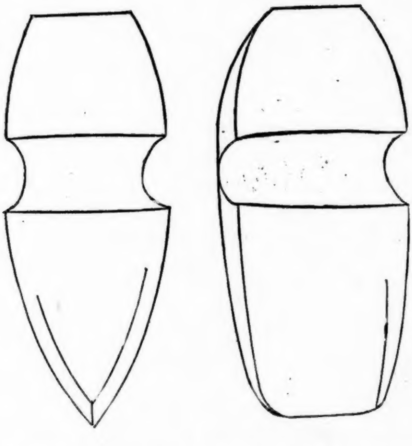
ANTHROPOLOGY.[1]

THE ABORIGINAL AX OF THE SALT RIVER VALLEY, ARIZONA.—The fertile alluvial lands of the great valley of Salt river, which have been lying idle for unknown centuries, are now being rapidly redeemed by irrigation and planting. Phœnix, the "Garden City" of Arizona, now numbers some 5000 inhabitants, and is rapidly growing in population and wealth upon the ground which was formerly densely occupied by a race presumably extinct, unless it finds representation in the Pimos and Maricopas of to-day.

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

Amongst the relics of the past turned up by the modern plough the aboriginal stone ax is the most conspicuous and abundant. The numerous specimens show that but one general form and type prevailed, and that the material in all was nearly the same—a compact, firm, dark-green dolerite. Availing doubtless of the river-worn boulders nearest to the desired form, the ancients shaped them by rubbing or grinding into axes of superior form and finish, capable of doing good service in cutting and hewing the soft cottonwood trees of the lowlands and even the harder mezquite of the first terrace where their homes were built.

The form of the ax is best described by the accompanying figures, in side view and top view. The groove or channel for



the withe or thong of rawhide for the handle is generally deep and left somewhat rough in surface, while the rest of the ax is ground smooth and is polished. In some specimens, however, the groove is also smooth and polished as if by long wear. This groove extends across the top of the ax and down the two sides, but not across the bottom, or under edge, which is left straight and is ground smooth, apparently for the reception of a key or wedge to tighten the clasp of the thong on the stone. In many specimens particularly in the heavy hammers or sledges, also found here, the borders of the groove are raised in a ridge a quarter of an inch or more above the general surface, thus giving a broader and firmer bearing for the thong while the blade and head of the ax are made smaller and thinner.

The thickness of the axes varies considerably, as also the length, due in part to wear by long use and repeated grinding.

The weight seldom exceeds three pounds, and the length eight to ten inches.

One double-bitted ax, an unusual form, is seven inches long and one and a quarter inches thick. It is well shaped and appears to have been an effective tool. The cutting edges of all the axes were formed with great care and are curved as in our modern axes. They bear indisputable evidence of careful grinding into shape and to a cutting edge. This grinding was done with great accuracy and skill. The rectilinear parallelism of the lines of abrasion is surprising. Evidence of the use of stone axes is found in the remnants of the cedar floor beams in the walls of the ruins of Casa Grande.—*Wm. P. Blake, Phœnix, Arizona, March, 1886.*

The so-called Deformed Crania.[1]—The discovery in Cuba of a series of crania commonly called deformed Carib skulls, is itself an argument against this identification, for it is well known that there never were either Caribs or practices of deformation in Cuba. M. le Docteur Montané read before this society, at a former meeting, an essay entitled, "A Cuban Carib," an epithet as opposed to the opinions of the author of the present paper as, for example, a Jamaican Aztec, a Venezuelan Quichua, a Portuguese Basque or a Magyar Englishman.

Let us establish who are the Caribs and under what circumstances were the crania found?

The Caribs, according to P. Casas and other chroniclers of America, were the inhabitants of Guadeloupe and Dominica, the first islands that opposed the Castilians. Christopher Columbus gave them the name, confounding them with the Chalybes of Asia, warlike people, neighbors to the Amazons, dwelt upon by the geographers and historians of antiquity.

These Caribs belonged to the same race as the other inhabitants of the archipelago, with no other difference except wearing the hair long and eating human flesh. This last accusation, unproved, extended later to other peoples of the continent belonging to different races. The word Carib became the synonym of anthropophagy, and there were Caribs throughout America, in Mexico, the Antilles, Brazil, &c. The first to bear this name disappeared a few years after, quicker than their relatives in other islands. War, slavery, and their own aggressive wars more promptly resulted in their extermination. In fact, half a century after the discovery of America, Guadeloupe, Dominica and adjacent islands were deserted. A new race of Indians established itself there and the land was occupied by France and other powers.

Thus the Indians called at the end of the seventeenth century Caribs by Breton, Du Tertre, Rochefort and Labat, and who,

[1] Read in Spanish before the Anthropological Society in Havana, Nov., 1885.

according to Rochefort, came from Florida (an incredible theory), and according to other authors from South America, were not the descendants of the first-named inhabitants of the archipelago. The authors named above depict their Caribs with racial characteristics quite different from those of the race anteriorly described by the first conquerors. Their language, according to Breton, had nothing in common with that familiar to Columbus and his companions. They were, moreover, much mixed with the negroes of Saint Vincent and Tabago, forming a race commonly called Carib negroes.

The opinions advanced in this study are related especially to the true and ancient Caribs of Columbus and the first chroniclers.

The plaster cast before us was taken from one of a number found, in 1847, in a cave near the eastern end of Cuba, by Miguel Rodriguez Ferrer, whose explorations, writings and official measures have contributed so much to scientific studies in our island. Two of these crania are now in Havana, where they were studied by the learned Poey; two others were sent to Madrid, where they were studied by MM. Graells, Vilanova and Peres Arcas; others remained in the possession of the discoverer. The original of this cast belonged to the University of Havana, and was destroyed by fire. Fortunately Sr. Nicolas Gutierez had preserved a perfect reproduction in plaster, which he presented to the Society of Anthropology.

The cranial measurements of Sr. Montané although useful, and indeed indispensable in other craniological studies, have no importance when we have to prove or disprove an historic fact as definite as the usage attributed to the Caribs and other American savages of voluntarily changing the form of the head. Craniological measures are useful in determining the characters of a large series or in deciding whether a given skull belongs to a class well known. But M. Montané does not possess the dimensions of a single series of crania called deformed Carib; what is more he has not the measures of one such. If such data existed they would be found in the best known texts, but we search for them in vain. Neither in public or private museums nor in atlases have we a single example of a deformed Carib skull. Only one has been described under this head in Morton's Crania Americana from a cast in Philadelphia, the original of which existed in Paris and had been used by Gall and Spurzheim in their phrenological studies.[1] But notice that this came from the Island of St. Vincent, the principal home of the Carib negroes. Moreover, this skull has not been measured by any modern methods, or at least Dr. Montané does not give them.

On the contrary, there is at Charleston a veritable Carib skull

[1] Dr. Moultrie, quoted by Morton, "Physical Type of American Indians," in Schoolcraft, "Archives," II.

from Guadeloupe; but, notice well, it is not flattened but, quite the contrary, very high in the crown, a decisive proof against the justice of the classification generally called "deformed Carib."

Finally, there are at Paris several other crania coming from the Lesser Antilles called Carib, which have been measured by modern methods. But, mark well, they are not deformed; that is to say, Dr. Montané does not possess the measurements of a single deformed Carib cranium.

Consequently he undertakes to discover resemblances between this and crania from Ancon, in Peru. He reports the measurement of two types of these the deformed and the non-deformed. The figures published in his work, if they prove anything, demonstrate that the skull in question is not Carib at all but of the non-deformed from Ancon, Peru.

On the contrary the report of M. Graells, Vilanova and Perez Arcas, signed by a large special committee of the Museum of Madrid relates to the two crania discovered by Sr. Ferrer.[1] The authors do not hesitate to recognize the resemblance between the two skulls before them and those generally called deformed Carib. They declare that a complete study of the question of artificial flattening is impossible without a numerous series of the same form. They close by saying that in relation to the two crania before them, they do not believe that there had been deformation but that the shape is natural.

Sr. Felipe Poey, who examined at Havana, about twenty years ago, two crania found by Sr. Ferrer, believed that one of them was perfectly natural. Sr. Rodriquez Ferrer himself did not believe them to be Carib, relying mainly upon the belief that we had never had Caribs in Cuba. Indeed, they never came in their excursions further than Porto Rico, or at least than Santo Domingo, they never flattened the skull, and finally their crania were not of the form which they had been supposed.

In 1512 an abandoned vessel was discovered on the coast of Guanimar, south side of Cuba. No trace of its crew was afterward found. Peter Martyr, from his library in Spain wrote that they were devoured by anthropophagous savages.

On the contrary Las Casas says: "This has not the slightest appearance of truth. No one has been able to prove that the Caribs—if there are any such people—have ever traveled so far from their islands, which are Guadeloupe and Dominica, situated far to the east of San Juan (Porto Rico). I believe that they land at l'Espagnole (Saint Domingo) only now and then. Those who speak like Peter Martyr take their fancies for realities."[2]

The phrase, "if there are any," applied to the Caribs would appear a little strange from the pen of such a great authority.

[1] Report presented at Madrid, March 24, by Srs. Graells, Vilanova and Perez Arcas.

[2] Casas, Historia de las Indias. Madrid, 1875, III, 484.

Casas had no faith in the charge of anthropophagy made against the Indians by the conquerors of the new world, an accusation which he attributed to a desire for a pretext to enslave the savages.

Still more strange is it that neither Casas nor any other of the earlier historians speak of the Indians called Caribs as applying to the heads of their infants apparatus to change the form—an ominous silence when we consider that these same writers are full of detail, false or true, relative to these same savages. In a word, Columbus, Chanca, Americus Vespucius, Bernal Diaz, Peter Martyr, En Ciso, Ferdinand Columbus, Las Casas, Oviedo, Gomara and many others for a century and a half after the discovery are unanimously silent about the artificial deformation of the cranium attributed in later times to the early inhabitants of the Lesser Antilles.

If the first witnesses and chroniclers on America are mute regarding deformation, they describe with great exactness the heads of the indigenes of these islands, and the result is that the skulls are very elevated in the crown.

The most ancient and authoritative of these witnesses, Christopher Columbus,[1] declares that the inhabitants of the Antilles, the Greater and the Lesser, and those of Terra Firma, resemble one another in respect to their natural form, with wide foreheads and heads well elevated.

There were not in the Antilles the two races as alleged, but one uniform race without variation of physical characters. This is so true that when, after ten years of exploration in the archipelago and the northern part of South America, Christopher Columbus arrived at the Island of Guanaja and the countries of Central America, where he found forms of head quite different from those which he had formerly seen, he recorded this fact in his notes.

Americus Vespucius,[2] who saw the same Indians on the islands as well as on the coast, compares their visages with that of the Tartars, who have the forehead very wide.

Doctor Chanca[3] asserts that the only difference among the Indians of these isles consisted in the pretended wearing long hair by the Caribs and the wearing by the women of a kind of cotton bands around the legs above and below the calf.

Bernal Diaz,[4] who never lived in America, but who saw at Seville some hundreds of Indians sent to be sold under the unjust accusation of being eaters of human flesh, many of whom he lodged in his own house, says the Caribs have the same physical conformation as others. "They are not more deformed than others, only they have this evil custom. In all the islands there

[1] F. Colon. Vida del Almirante, cap. 89. Casas. Historia, III, 109, 113.
[2] Premier Navigatum.
[3] Chanca. Lettre au Municipe de Seville, Jan., 1494. Coll. de Navarrete, I, 353, 358.
[4] Bernal Diaz. Historia de los Reyes Católicos, cap. 118.

is no difference either in the form or the manners of the inhabitants, nor in their language. All have the face and forehead long, the head round, with the same distance between the temples as from the forehead to the occiput."

We may affirm then, in virtue of this testimony, that the primitive Caribs had no habits of deformation, and that their heads, instead of being elongated and flattened as was supposed, were round and elevated.

Oviedo[1] was the first to start the report of the existence of voluntary deformation in America. In his edition of 1535 he says that the inhabitants of St. Domingo had the forehead very wide on account of certain manipulations, " For at the moment of birth they press the forehead and the occiput of children."

Such treatment would not effect a permanent change in the form of the head.[2]

Gomara[3] expresses himself in parallel terms in relation to Saint Domingo, only he specifies that it was the wise women to whom was due the shape of the head in these Indians. He adds, regarding the Indians of Cumaná, that the pressure made at the moment of accouchment was effected by two bundles of cotton. Gomara was never on American soil.

Las Casas[4] says that in Peru it was a great privilege granted to certain chiefs whom they wished to honor to give to the heads of their infants the form of those of the king and princes of the royal family.

From this we conclude that the practice was neither obligatory nor general, nor practiced upon the heads of the royal family. Moreover Casas was never in Peru. On the contrary he knew Saint Domingo better than did Oviedo, but says not one word concerning the heads of the inhabitants of that island. He knew Central America better than did Oviedo, and though he mentions practices attributed to mothers or wise women, deformations of the skull have no place.

It is Cieza de Leon[5] who commences to speak vaguely of wooden apparatus applied to the heads of Indians. He says that among the Chancos, in the province of Quimbaya, and in other regions they compress the heads of new-born babes with tablets which are replaced later on by ligatures.

It is astonishing that with respect to the Caraques, near Manta, by Quito, the operation is reversed, first the bandages and then the tablets, which in his opinion remain four or five years in place. But he knows only indifferently the countries of which

[1] Oviedo. Historia general y Natural de Indias, II, cap. 5; XLII, cap. 3.

[2] Topinard. Elements d'Anthropologie generale. Paris, 756.

[3] Gomara. Historia de las Indias. Madrid, 1852, 172, 206.

[4] Casas. Apologetica Historia, cap. 34, 392.

[5] La Cronica del Perú, cap. 26, 378, 1853. Madrid. Also cap. 50, 404; also cap. 45, 399.

he speaks, as himself avows. As to Peru proper, he mentions the deformative process only among the Collas, saying nothing of Cuzco, Lima and other places in the empire. Moreover this author is one of the most credulous of his time.

Finally, Garcilaso[1] reports that the Indians of Manta, by Quito, deform the heads of their children by means of two tablets which they tighten more and more every day during four or five years. He says that in Tula, or Florida, the same result was attained by means of certain ligatures which they used nine or ten years. But Garcilaso visited neither of these countries. Cabeza de Vaca lived ten years in Florida, describes many customs of the Indians, but makes no mention of deformation. As to Quito, Garcilaso evidently copies Cieza.

It is with relation to Peru proper, where he was born and where he lived up to his twentieth year, that Garcilaso is an authority of the first order. He says not one word of deformation among the Collas nor of any place in the empire of the Incas. It is improbable that he would have omitted an operation so common and one practiced on his own head, if it had existed. Moreover he describes what is done to infants at the moment of birth and during lactation. Instead of the compression of the head, either by the hands, or by bandages, or by tablets, the head is left entirely uncovered and is never touched, particularly near the brain, while the body and arms are securely wrapped.

There are many other narratives of the conquest, but in none of them is there the least confirmation of the statement as to cranial deformation. Human nature is so prone to receive without examination extraordinary statements, that the ball of snow of voluntary deformations in America attained colossal proportions. That which began by being credited concerning three or four regions wide apart, finishes by being extended over the entire continent.

A century and a half after the extinction of the Caribs from the Lesser Antilles, we find other savages in the same islands, in regard to whom the voyagers of their time have repeated all the stories, false or true, that the first Spanish conquerors told concerning various Indian populations.

It has been said that this absurd practice endured long after the conquest, and that it was forbidden by order of the Spanish government, according to others by the decisions of a council of Lima, according to others by a papal decree. The Marquis de Nadaillac affirms that the council in question was held in 1545; but M. Topinard believes that it took place in 1585, and that in 1752 the governor of Lima published a new edict against deformations. Now, there were no councils held in Lima in 1545 and 1585. The five councils held there took place in 1551, 1567,

[1] Garcilaso de la Vega. Comentario reales de los Incas, IX, cap. 8; La Florida del Inca, IV, cap. 15; Comentarios, IV, cap. 12.

1583, 1591 and 1601. The decisions are preserved, and there are not the slightest allusions to deformation.[1]

Rivero and Tschudi[2] visited a large number of Peruvian tombs, examined the mummies in them, among others a fœtus of seven months old, still in the mother's womb, many children of all ages, and of adults, and having observed throughout the same cranial form, without the least vestige of depression nor of deforming apparatus, they came to the conviction that this was the natural form of the head.

M. Robertson[3] examines no less minutely the platicephalic crania of the mound-builders of the United States, supposed to be deformed, and the analysis convinced him that the crania were natural.

We have seen in a former citation that according to Casas the heads of Guatemala Indians deformed in times anterior to the discovery, had given rise by inheritance to crania spontaneously deformed. According to other witnesses the same thing took place among the Omaquas of South America.[4] The practice having been attributed to these savages by Ulloa, an affirmation repeated in 1754 by Unarte, it results that this form of head is at present perfectly natural and that "Children come into the world in this tribe and some others with the head dislocated."

The same result follows concerning the three races of Peru that exist at this moment with the same form of head that they formerly had, without any need of deformatory practices. In the words of Rivero and Tschudi:[5] "But there is one proof still more conclusive against the usage of mechanical means; it is the actual existence of three races, in distinct although contracted areas, where we find no trace of bandage nor of pressure exercised on the head of the new born.

It is then demonstrated there is neither historic, scientific nor rational base for the affirmation that in Tropical America there were countries where the head was modified in form by mechanical means. Nature by its own forces was entirely equal to the task of producing then and producing to-day these same forms in many parts of the world.

This truth is still more evident in relation to the savages, called Caribs, of the Lesser Antilles; first, because none of the earliest chroniclers attribute to them a similar habit, and secondly, because no one has found the form of head that has been attributed to them.—*Juan Ignacio de Armas.*

[1] Leyes de Indias; Solerzano, Politica Indians; Hernaez, Coleccion de Bulas Breves, y ottos Documentos relativos a la Iglesia de America y Filipinàs. Bruxelles, 1879.

[2] Rivero et Tschudi. Antiquida des Peruânas. Vienna, 1851, p. 52.

[3] S. Robertson. Les Mound Builders. Cong. Internat. d'Américanistes. Luxemburg, I, 43.

[4] Sobron. Los idiomas de la America lateria. Madrid, 106.

[5] Rivero and Tschudi, *op cit.*

MICROSCOPY.[1]

An Alcoholic Drip for the Thoma-Jung Microtome.—As is well known, sections of many hardened specimens may be readily made without imbedding by simply fastening them in the holder of a microtome, with or without cork, pith, etc., for support. Trial sections of moderate thinness thus made often prove surprisingly useful. Decalcified bone, cartilage, kidney, and many other *hardened* animal tissues may be examined with great despatch, while stems, roots, and other fairly rigid portions of plants also give excellent results. This simple method generally demands, however, that the object shall be constantly flooded with strong alcohol, and the same necessity exists always in the use of celloidin, which we have found to be an imbedding material of great utility, especially in vegetal histology. For the Schanze and other microtomes, in which the object is raised without any lateral movement, a simple siphon, consisting partly, at least, of rubber

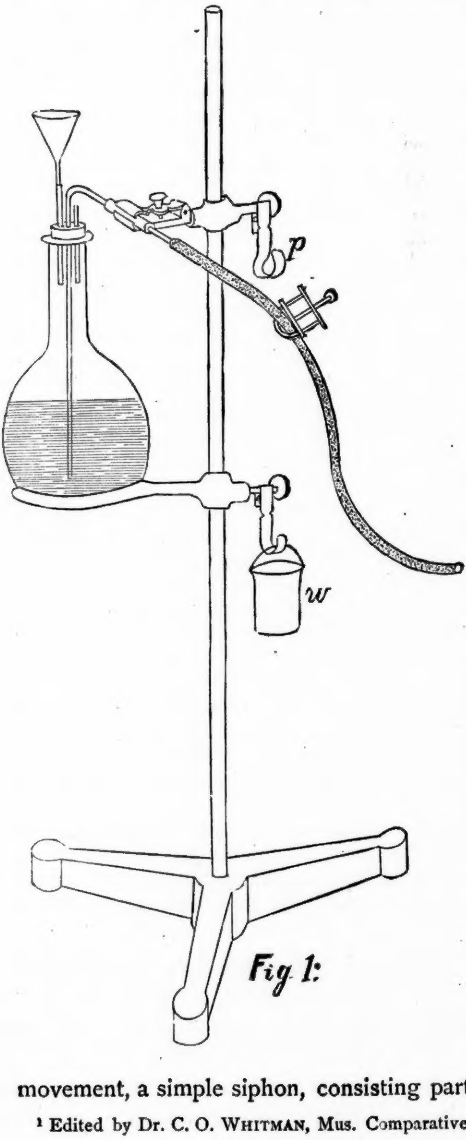


Fig. 1:

[1] Edited by Dr. C. O. Whitman, Mus. Comparative Zoology, Cambridge, Mass.

tubing, upon which is placed a common screw-clamp for regulating the outflow, supplies a dripper which is effective and quickly home-made in any laboratory. For the Thoma microtome it is also available, either by flooding the knife when this is set slanting and pushed clear of the instrument, or by frequent readjustments to compensate the progress of the object up the inclined plane. Either of these expedients, however, involves objections which are avoided by the use of the simple apparatus here figured.

Constant pressure and flow are secured by the siphon which is

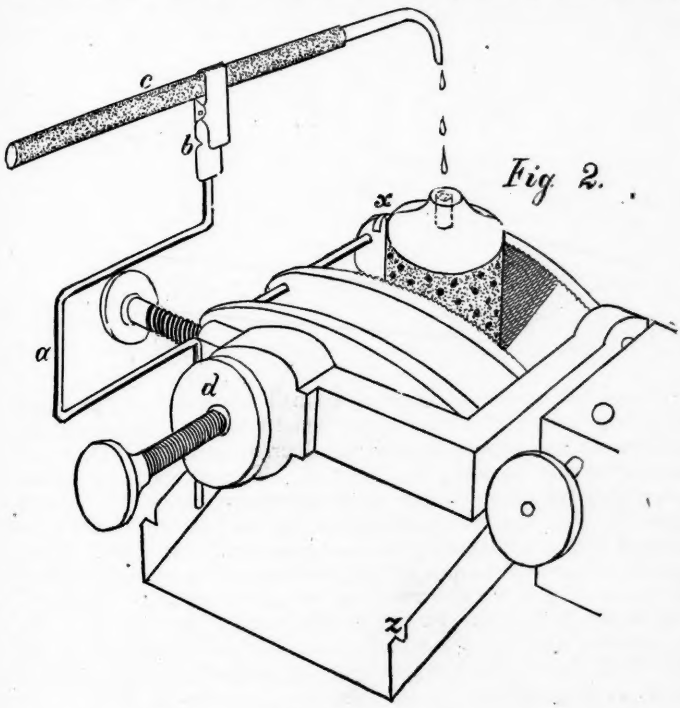


Fig. 2.

obtained conveniently as in Fig. 1. The stopper of the flask or bottle may, of course, be omitted, but in the figure it has three holes: one for the siphon-tube, one for a small funnel, and one for the exit of the vapor when alcohol is poured in through the funnel.

For use with the Thoma microtome the end of the flexible siphon-tube is attached to the object-holder in such a way as to travel with it, and hence over the object, wherever it goes (Fig. 2). This is done by means of a bent (or straight) stiff wire (*a*),

to the top of which is soldered a clipp or grip (*b*), which embraces the end of the siphon-tube (*c*), as shown in the figure, and gives adjustment by allowing the dripper to be pushed back or forth. Instead of the wire and clip a "sleeve-holder" having a long shank may be used, after merely straightening out and twisting the shank. Attachment of the wire to the object-holder is secured by the collar (*d*), which is screwed down firmly upon the wire and gives at the same time a second and valuable adjustment about a vertical axis. To carry off and save the alcohol a copper or tin trough is used, and is shown in Fig. 3. It may be readily made by "bending up" a thin flat piece of the metal, and

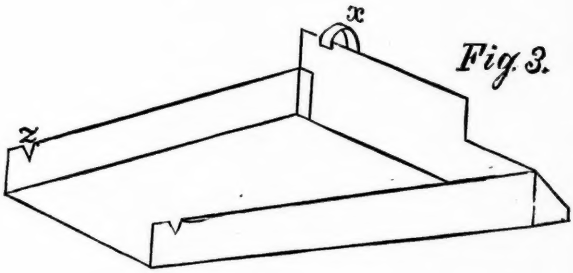


Fig. 3.

is completed by the addition of a small hook (*x*) of the same material, though this may be dispensed with. The trough fits underneath and behind the object-holder, as shown in Fig. 2, the hook *x* serving to hang it (Fig. 2, *x*). The notches, *z z*, in the trough are for a loop of wire or string passing about the neck of a beaker (Fig. 1*w*), which is thus carried underneath, catches the alcohol, and is occasionally emptied into the siphon-flask. When not in use the siphon-drip and the wire are removed by loosening the collar (Fig. 2, *d*), and are hung as one piece upon the bull-dog hook (*p*, Fig. 1). In the devising and constructing of the apparatus I have been constantly aided by my friend and pupil, Mr. G. E. Stone, who has also made the accompanying drawings. —*W. T. Sedgwick.*

SCIENTIFIC NEWS.

— The Audubon Society.— The Audubon Society (named after the great naturalist), founded last February, is rapidly increasing its membership in all parts of the country. The purpose of the society is to prevent—(1) The killing of any wild bird not used for food. (2) The taking or destroying of the eggs or nests of any wild birds. (3) The wearing of the feathers of wild birds. The office is at 40 Park Row, New York.

The society wishes a local secretary in every town and village to secure signers of its pledges ; and will upon application furnish circulars of information and pledge forms. Upon the return of the signed pledges certificates of membership will be issued. Beyond the promise contained in the pledge no obligation nor responsibility is incurred. There are no fees, no dues, nor any expenses of any kind. There are no conditions as to age.

The promoters of the movement are sanguine of effecting a great change of sentiment relative to the destruction of our songsters and insect-destroying birds for hat decoration.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

National Academy of Sciences, April 20–22, 1886.—The following are the titles of the papers read at the session:

The geologic age of the Equus fauna. By G. K. Gilbert.

The Cowles electrical furnace. By T. Sterry Hunt.

On the phylogeny of the Batrachia. By E. D. Cope.

On the phylogeny of the placental Mammalia. By E. D. Cope.

The comet of Biela. By H. A. Newton.

Areas of high barometric pressure over Europe and Asia. By Elias Loomis.

The cockroach in the past and in the present. By S. H. Scudder.

On the diathermancy of ebonite and obsidian, and on the production of calorescence by means of screens of ebonite and obsidian. By Alfred M. Mayer.

On the coefficient of expansion of ebonite. By Alfred M. Mayer.

On the determination of the cubical expansion of a solid by a method which does not require calibration of vessels, weighings, or linear measure. By Alfred M. Mayer.

On measures of absolute radiation. By Alfred M. Mayer.

On the geology of the region near Zacualtipan, Hidalgo, Mexico. By E. D. Cope.

On ancient and modern methods of arrow release. By Edward S. Morse.

The ordinal and super-ordinal groups of fishes. By Theo. Gill.

On the absolute and relative wave-length of the lines of the solar spectrum. By H. A. Rowland.

Platinous compound as additive molecules. W. Wolcott Gibbs.

Influence of magnetism on chemical action. By Ira Remsen.

Upon the deaf and dumb of Martha's Vineyard (continuation of research relating to the ancestry of the deaf). By Alexander Graham Bell.

On the invisible spectra. By S. P. Langley.

Cretaceous metamorphic rocks of California (by invitation). By G. F. Baker.